Appendix K
Sampling Standard Operating Procedures

Appendix K. Sampling Standard Operating Conditions

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List of Acronyms

AB	Afterburner
ACAMS	Automatic Continuous Air Monitoring System
ACS	Agent Collection System
ADAFC	Air Dilution Air Flow Controller
AQS	Agent Quantification System
ASC	Allowable Stack Concentration
AWFCO	Automatic Waste Feed Cutoff
BIF	Boiler and Industrial Furnace (Regulations)
BRA	Brine Reduction Area
BSR	Burster Size Reduction (Machine)
BTU	British Thermal Units
CAMDS	Chemical Agent Munitions Disposal System
CCC	Continuing Calibration Check
CEMS	Continuous Emissions Monitoring System
CESA	Charge End Subassembly
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CRT	Cathode Ray Tube
CVAAS	Cold Vapor Atomic Absorption Spectroscopy
DAAMS	Depot Area Air Monitoring System
DAFC	Dilution Air Flow Controller
DCD	Deseret Chemical Depot
DESA	Discharge End Subassembly
DFS	Deactivation Furnace System
DoD	Department of Defense
DRE	Destruction and Removal Efficiency
DUN	Dunnage Incinerator
DWP	Detailed Work Plan
ECR	Explosion Containment Room
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FPD	Flame Photometric Detector
GB	Chemical Nerve Agent (Isopropylmethyl-phosphonofluoridate, Sarin)
GC/FID	Gas Chromatograph/Flame Ionization Detection
GC/FPD	Gas Chromatograph/Photometric Detection
GC/MS	Gas Chromatograph/Mass Spectrometry
GFAAS	Graphite Furnace Atomic Absorption Spectroscopy
GPD	Gas Plasma Display
GRAV	Gravimetric Analysis for Total Unspeciated Organics
HD	Chemical Blister Agent (Bis (2-chloroethyl) sulfide, mustard, H-series)
HDC	Heated Discharge Conveyor
HRA	Health Risk Assessment
HRGC/HRMS	High Resolution Gas Chromatograph/High Resolution Mass Spectrometer

List of Acronyms (continued)

HVAC	Heating, Ventilating, and Air Conditioning System
IC	Ion Chromatograph
ICAP	Inductively Coupled Argon Plasma Emissions Spectroscopy
ID	Induced Draft (Fan)
I.D.	Inner Diameter
IDLH	Immediately Dangerous to Life and Health
LCS	Laboratory Control Sample
LIC	Liquid Incinerator
LOQ	Limit of Quantitation
MDB	Munitions Demilitarization Building
MDM	Munitions Demilitarization Machine
MPF	Metal Parts Furnace
MS	Mass Spectrometry
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NDIR	Nondispersive Infrared Analyzer
OVT	Operational Verification Test(ing)
P&A	Precision and Accuracy
PAS	Pollution Abatement System
PCC	Primary Combustion Chamber
PCDD	Polychlorinated Dibenzo-p-dioxin
PCDF	Polychlorinated Dibenzofuran
PCR	Post Column Reactor
PDARS	Process Data Acquisition and Recording System
PIC	Products of Incomplete Combustion
PLC	Programmable Logic Controller
PM	Particulate Matter
PMD	Projectile/Mortar Disassembly
POHC	Principal Organic Hazardous Constituent
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RE	Removal Efficiency
ROHA	Rolling Hourly Averages
RPD	Relative Percent Deviation
SCC	Secondary Control Chamber
SDS	Spent Decontamination Solution
STEM	Sampling Train for Energetic Materials
TB	Trial Burn
TCD	Thermal Conductivity Detector
TCLP	Toxicity Characteristic Leaching Procedure
TCO	Total Chromatographic Organics
TEF	Toxic Equivalency Factors
TIC	Tentatively Identified Compound
TOC	Total Organic Compounds

List of Acronyms (continued)

TOCDF	Tooele Chemical Demilitarization Facility
TOX	Toxic Cubicle
TSDF	Treatment, Storage, and Disposal Facility
TWA	Time Weighted Average
USEPA	United States Environmental Protection Agency
VOST	Volatile Organic Sampling Train
VX	Chemical Nerve Agent (Phosphonothioic acid, methyl-,s- (2-bis (1-methylethylamino) ethyl) o-ethyl ester)

List of Units and Measurements

acfm	Actual Cubic Foot Per Minute
afpm	Actual Foot Per Minute
ΔP	Delta P
dscf	Dry Standard Cubic Foot
dscf/hr	Dry Standard Cubic Foot per Hour
dscfm	Dry Standard Cubic Foot Per Minute
dscm	Dry Standard Cubic Meters
° F	Degree Fahrenheit
ft	Foot
g	Grams
gal	Gallon
gpm	Gallons Per Minute
gr	Grain
gr/dscf	Grains Per Dry Standard Cubic Foot (1 atm, 68□F)
g/s	Grams Per Second
g/hr	Grams Per Hour
inch Hg	Inches of Mercury
inchwc	Inches of Water Column
kg/hr	Kilograms Per Hour
L	Liter
lbs/hr	Pounds Per Hour
Lpm	Liters Per Minute
mg	Milligram
mg/dscf	Milligrams Per Dry Standard Cubic Foot
mg/dscm	Milligrams Per Dry Standard Cubic Meter
mg/m^3	Milligrams per Cubic Meter
mL	MilliLiters
MW	Molecular Weight
N	Normal
ng	Nanogram
π	Pi = 3.141592654
PB	Barometric Pressure
pg	Picogram
ppmdv	Parts Per Million on a Dry Volume Basis
RPM	Revolutions Per Minute
µL	MicroLiter
µg	Microgram
µg/dscf	Micrograms Per Dry Standard Cubic Foot
$\mu g/m^3$	Micrograms per Cubic Meter

List of Chemical Symbols and Formulas

Ag	Silver
Al	Aluminum
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
Cd	Cadmium
Cl_2	Chlorine
CH_2Cl_2	Methylene Chloride (Dichloromethane)
CH_3COCH_3	Acetone
CH_3OH	Methanol (Methyl Alcohol)
$C_6H_5CH_3$	Toluene
CO_2	Carbon Dioxide
CO	Carbon Monoxide
Co	Cobalt
Cr	Chromium (total)
Cr^{+6}	Hexavalent Chromium
Cu	Copper
DI H_2O	Deionized Water
F	Fluoride
HCl	Hydrochloric Acid
HF	Hydrogen Fluoride
Hg	Mercury
HNO_3	Nitric Acid
H_2O_2	Hydrogen Peroxide
H_2SO_4	Sulfuric Acid
$KMnO_4$	Potassium Permanganate
KOH	Potassium Hydroxide
Mn	Manganese
NaOH	Sodium Hydroxide
NaOCl	Sodium Hypochlorite
Ni	Nickel
O_2	Oxygen
P	Phosphorous
P_2O_5	Phosphorous Pentoxide
Pb	Lead
Sb	Antimony
Se	Selenium
Sn	Tin
SO_2	Sulfur Dioxide
2,4,6-TNT	2,4,6-Trinitrotoluene
Tl	Thallium
V	Vanadium
Zn	Zinc

Appendix K. Sampling Standard Operating Conditions

Section I. Introduction

1. Background.

a. The Trial Burn program involves conducting a baseline (fuel-only) test run and a series of three performance runs on the MPF. The test runs will be a minimum of six-hours duration for the organic species (PCDD/PCDF, volatile and semivolatile PICs), and two-hours duration for the inorganic species (particulate, HCl, Cl_2, and metals).

b. Exhaust gas and process stream samples will be collected during each run. The results from each test run, and the average of each set of three test runs will be presented in fulfillment of the RCRA requirements.

c. During the mobilization phase for the trial burn, trained and experienced engineers, scientists and technicians will prepare, calibrate, and perform QC checks on the equipment to be utilized during the field effort. All the calibrations will be documented and kept in the project file. All calibration documents will be available during the course of the field test programs and will be submitted with the Trial Burn Final Report for review.

d. Contractor personnel will inspect, wash, and rinse all sample train glassware and inspect all pre-cleaned sample containers. The equipment will be packed in specially designed shipping containers for transport to the site.

e. Team meetings will be held to ensure that all members understand the objectives and goals of each program prior to initiation of the field effort.

2. Laboratory Analyses. All sample analyses will be conducted by laboratories maintaining Utah certification for the analyses to be conducted during this trial burn.

3. Trial Burn Final Report

a. CAMDS will submit a complete Trial Burn Final Report providing operating details and outlining the goals, methods and results for the trial burn program. The Trial Burn Final Report will be submitted as required by Module VI of the Part B permit. Data will be reagent blank-corrected, as allowed by the individual methods, and reported. VOST data will be blank-corrected according to the *Handbook on Quality Assurance/Quality Control Procedures for Hazardous Waste Incineration,* (EPA-625-66-89-023), January 1990. VOST data will be reported both blank-corrected and uncorrected. Particulate and metals data will be blank-corrected in accordance with Methods 5i and 0060, respectively.

b. Any foreseen deviations from the SSOP will be submitted for DSHW approval in advance of the scheduled testing. Approval will be obtained in writing prior to mobilization. It is not anticipated that significant changes in the sampling approach will occur to the extent that they would cause delays in the program. All deviations, if any, will be documented and included in the Trial Burn Final Report. The Final Report will undergo technical review by CAMDS personnel prior to release to the State of Utah DSHW.

4. Project Schedule. The sampling project schedule for the trial burn is set up in three phases. Phase One includes program design and pre-sampling activities (pre-test). Phase Two is the field set-up of the test equipment, stack sampling, and data gathering. Phase Three consists of post-sampling and report generation (post-test).

5. Pre-Test. During the pre-test portion of the trial burn program, all project management and sampling details are defined. Responsibilities are assigned to the respective qualified team members who will then prepare the program to ensure a successful test. The test plan is finalized and approved. Equipment related pre-sampling activities, including calibrations, will take place prior to equipment arriving at the test site.

6. Audit Samples

a. A VOST audit cylinder may be supplied by DSHW or the EPA to be sampled and analyzed for validation of the volatile organic compounds for the surrogate trial burn. These audit samples will be collected using the VOST train (EPA Method 0031) and the samples submitted to the laboratory for analysis. The audit samples will be collected at the conclusion of the trial burn to avoid any contamination of the VOST glassware with the audit compounds.

b. Dioxin or other audit samples, if supplied by EPA under proper custody, will be accepted by the sampling contractor and submitted to the laboratory along with the field samples. The audit sample will be prepared and analyzed along with the field samples.

7. Field Test. The field test will include set-up of the test equipment, sampling of PAS exhaust gases, sampling of the MPF process streams, and operations data gathering.

8. Post-Test. Post-test activities will include data reduction and report generation, analytical laboratory coordination and QA/QC of all data and reports.

Table K-1-1. Summary of Sampling to be Conducted in the MPF Trial Burn and Compliance Test				
System	**Run No.**	**Run Designation**	**Feed/Process Samples To Be Collected**	**Stack Gas Samples To Be Collected**
MPF	B	Baseline	Scrubber Brine, Process Water, NaOH Makeup, TC Residue	MPF PAS Outlet Stack: Method 0040 Total Organics Method 0031/Volatile Organics Method 5i PM Method 0050 HCl/Cl_2 Method 0060 HRA Metals Method 0010 Total SVOL Organics Method 0010 Semivolatile Organics Method 0023A PCDD/PCDF Method 25A Total Hydrocarbons Method 9 Opacity Method 3B O_2, CO_2
MPF	1, 2, 3,	Agent HD Performance Runs	Agent HD, Scrubber Brine, Process Water, NaOH Makeup, TC Residue	MPF PAS Outlet Stack: Method 0040 Total Organics Method 0031/Volatile Organics Method 5i PM Method 0050 HCl/Cl_2 Method 0060 HRA Metals Method 0010 Total SVOL Organics Method 0010 Semivolatile Organics Method 0023A PCDD/PCDF Method 25A Total Hydrocarbons Method 9 Opacity Method 3B O_2, CO_2

[1] - O_2 and CO will be determined by facility CEMS and recorded on the PDARS.

Section II. Sampling Locations and Frequency

The sampling contractor will collect exhaust gas and process samples during the Trial Burn. The sampling locations for the MPF are described in the following paragraphs.

1. Exhaust Gas Sampling Locations. MPF Tests. During the trial burn, the sampling ports and locations shown in Figure K-2-1 will be used for the sampling of parameters specific to this SSOP. Upper sections of the stack contain a number of sampling ports as identified in Levels A, B, C, and D. Two ports are located at each section, allowing for the simultaneous operation of two trains at each location. An additional port located at Level A is used for low-level agent sampling with the ACAMS and the DAAMS array for agent monitoring during agent operations. All sampling locations meet the accepted standards for distance from flow disturbances. EPA Method 1 was used to establish the required traverses for the sampling points. These points are shown in Figure K-2-2. Table K-2-1 identifies the sampling locations for the individual test trains.

2. Process Stream Sampling Locations. The sampling locations for the MPF process streams are identified as follows:

Sample Description	Sampling Point	Frequency
Scrubber Brine	Pump Discharge	Grab samples will be collected in the last hour of Test Runs 1, 2, and 3. Three discrete samples will be collected during each of Runs 1, 2 and 3. The first brine sample will be collected one hour after sampling begins. The second sample will be collected at port change and the third sample will be collected during the last hour of the run. A total of six brine samples collected per test condition.
NaOH Makeup	Pump Discharge	1 sample per test burn
Process Water	Valve	1 sample per test burn
Chamber Residue (TC Ash)	TC	1 sample per run[a]

[a] Ash residues will be collected from each TC after a sufficient cool down period. A composite sample will be collected from each TC at the conclusion of the test burn.

Figure K-2-1. MPF Process Schematic Showing Major Sampling Points

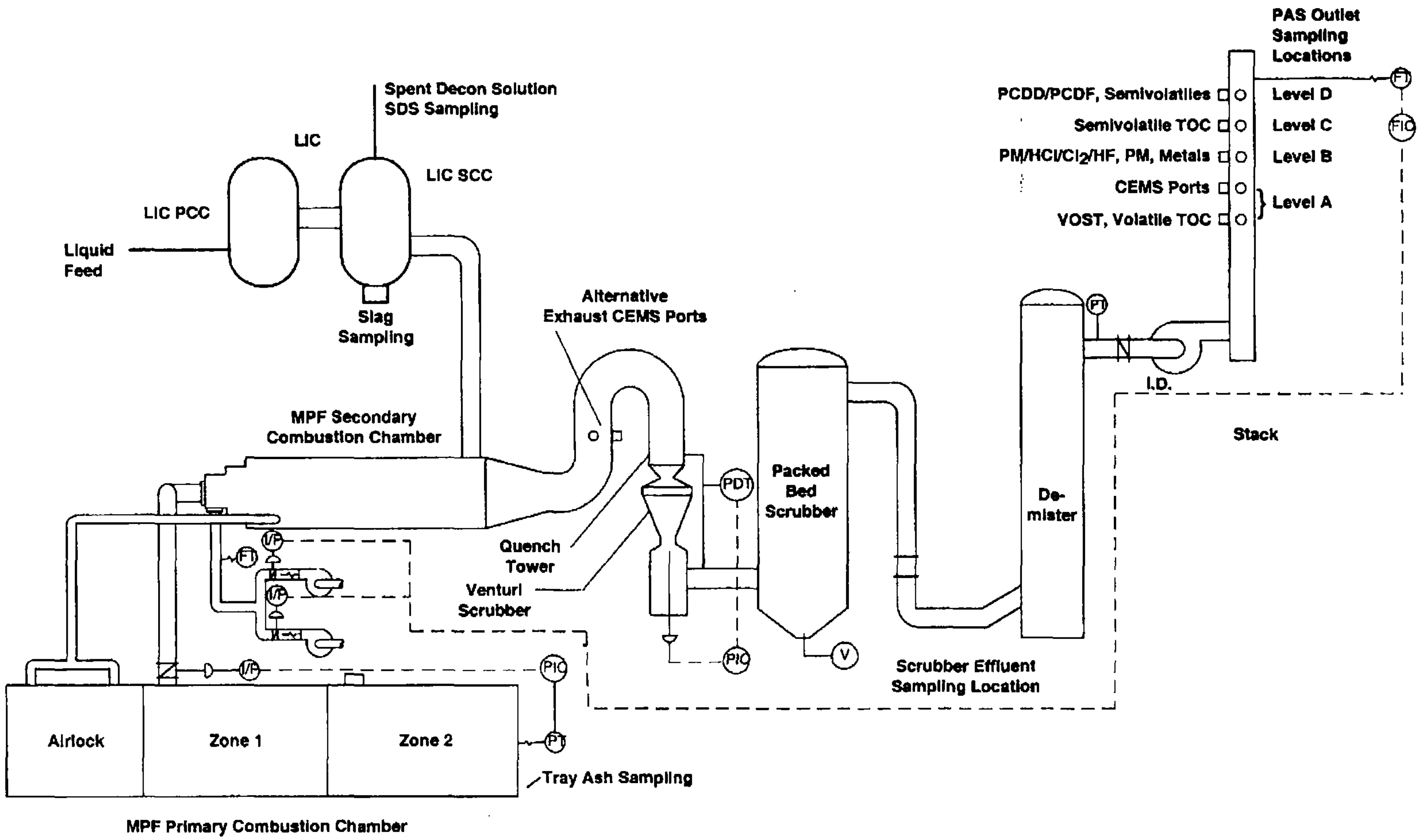
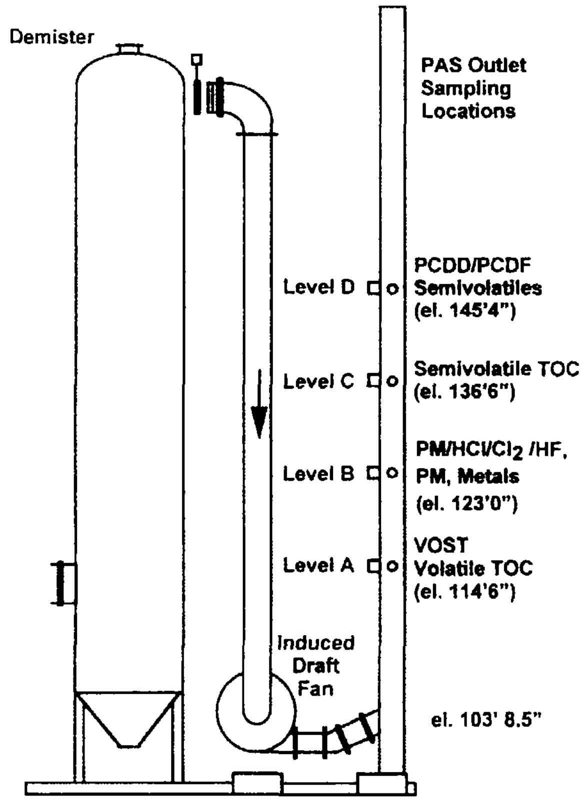


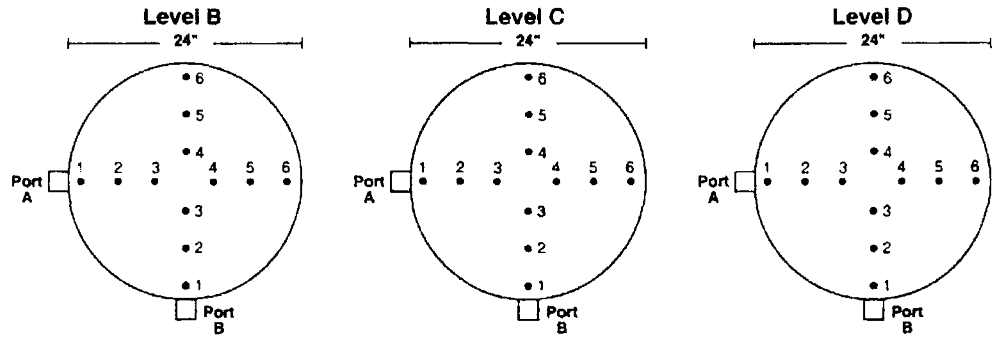
Figure 2-1. LIC Process Schematic Showing Major Sampling Points

01280/FOLDER 1/A

Figure K-2-2. MPF PAS Outlet Sampling Location and Traverse Points

Number of Diameters from Nearest Upstream Disturbance	
Level	No. of Diameter
A	5.4
B	9.6
C	16.4
D	20.8





Level B Isokinetic Trains		
Point	Percent of Stack Diam.	Distance from Wall (in.)
1	4.4	1.06
2	14.6	3.50
3	29.6	7.10
4	70.4	16.90
5	85.4	20.50
6	95.6	22.94

Level C Isokinetic Trains		
Point	Percent of Stack Diam.	Distance from Wall (in.)
1	4.4	1.06
2	14.6	3.50
3	29.6	7.10
4	70.4	16.90
5	85.4	20.50
6	95.6	22.94

Level D Isokinetic Trains		
Point	Percent of Stack Diam.	Distance from Wall (in.)
1	4.4	1.06
2	14.6	3.50
3	29.6	7.10
4	70.4	16.90
5	85.4	20.50
6	95.6	22.94

Figure 2-2. LIC PAS Outlet Sampling Location and Traverse Points

91280/FOLDER 1/B

Table K-2-1. Typical MPF Trial Burn Run Daily Schedule

<table>
<tr><th rowspan="2">Stack Level</th><th rowspan="2">Example Starting Port[1]</th><th rowspan="2">Sampling Procedure</th><th rowspan="2">Analyte Group</th><th rowspan="2">Method</th><th rowspan="2">Projected Total Time (hrs)</th><th colspan="6">Expected Sampling Schedule (hour)</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td>A-A</td><td>A</td><td>Non-Isokinetic</td><td>Total Volatile Organics</td><td>Method 0040/Total Organics[2]</td><td>6</td><td colspan="6">X............................X............................X</td></tr>
<tr><td>A-A</td><td>B</td><td>Non-Isokinetic</td><td>Volatile Organics</td><td>Method 0031</td><td>6</td><td colspan="6">X..................X..................X..................X</td></tr>
<tr><td>B-B</td><td>A</td><td>Isokinetic</td><td>$PM/PM_{10}/HCl/Cl_2$[3]</td><td>Method 5i/0050[3]</td><td>2</td><td colspan="2">X..........X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>B-B</td><td>B</td><td>Isokinetic</td><td>PM/PM_{10}</td><td>Method 5i</td><td>2</td><td colspan="2">X..........X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>B-B</td><td>A</td><td>Isokinetic</td><td>HRA Metals</td><td>Method 0060</td><td>2</td><td></td><td></td><td></td><td colspan="2">X..........X</td><td></td></tr>
<tr><td>C-C</td><td>A</td><td>Isokinetic</td><td>Total Semivolatile Organics</td><td>Method 0010/Total Organics</td><td>6</td><td colspan="6">X..X</td></tr>
<tr><td>D-D</td><td>A</td><td>Isokinetic</td><td>PCDD/PCDF</td><td>Method 0023A</td><td>6</td><td colspan="6">X..X</td></tr>
<tr><td>D-D</td><td>B</td><td>Isokinetic</td><td>Semivolatile Organics</td><td>Method 0010</td><td>6</td><td colspan="6">X..X</td></tr>
<tr><td>A-A</td><td>C</td><td>Non-Isokinetic</td><td>Total Hydrocarbons</td><td>Method 25A</td><td>6</td><td colspan="6">X..X</td></tr>
</table>

[1] - Starting ports are presented for reference purposes only. Each isokinetic train will sample exhaust gas from each of the two ports at the given stack level.
[2] - M0040 samples will be analyzed onsite within two hours of collection. Three samples will be collected and one will be field spiked.
[3] - The M5i train will be run in duplicate. One of the trains will be run as a M0050 train, utilizing M0050 train reagents in the back half for collection of HCl and Cl_2.

Section III. Sampling Methodologies

1. Overview. Follow the procedures outlined below during the field sampling program. Throughout the overall program, the sampling contractor will utilize EPA approved sampling methods. Any foreseen deviations from the SSOP will be submitted for DSHW approval. All deviations, if any, will be documented and included in the Trial Burn Final Report.

2. Field Program Description

a. As presently configured, this HD trial burn will entail one baseline and three performance test runs on the MPF.

b. All sampling of the MPF will revolve around the six-hour test runs for the volatile and semivolatile organic PICs, total organics, and PCDDs/PCDFs.

c. Opacity measurements will be made by State of Utah-certified visible emissions observers, in accordance with EPA Method 9. CAMDS personnel will conduct the opacity readings.

d. The test methods that will be utilized by the sampling contractor are as follows:

(1) EPA Method 1 and 2 -	Velocity Profile and Volumetric Flow Rate
(2) EPA Method 3 -	O_2 and CO_2 Concentration
(3) EPA Method 4 -	Moisture Content
(4) EPA Method 5i/0050 -	Combined Train for PM and HCl/Cl_2 Emissions, Front-half of 5i train analyzed gravimetrically, and will assume that all particulate matter is PM_{10} Back Half of 5i/0050 train analyzed for HCl and Cl_2
(5) EPA Method 5i -	Duplicate M5i Train for PM Emissions, Front-half of 5i train analyzed gravimetrically, and will assume that all particulate matter is PM_{10}
(6) EPA Method 25A -	THC Emissions
(7) SW-846 Method 0023A -	PCDD/PCDF Emissions
(8) SW-846 Method 0060 -	HRA Metals Emissions (will assume that all Cr is hexavalent chromium)
(9) SW-846 Method 0010 -	Semivolatile Organics Emissions
(10) SW-846 Method 0031 -	Volatile Organics Emissions
(11) EPA Draft Method -	Guidance for Total Organics, Final Report, March 1996 - SW-846 Method 0040 for Total Volatile Organics - SW-846 Method 0010 for Total Semivolatile Organics

3. Pre-sampling Activities. Pre-sampling activities include equipment calibration, sample media preparation, pre-cleaning of the sample train glassware and other miscellaneous tasks. Each of these activities are described or referenced in the following subsections. Other pre-sampling activities include team meetings, equipment packing, equipment setup and finalization of all details leading up to the coordinated initiation of the sampling program. Additionally, each team member will be provided a copy of the SSOP and supporting QAPP to foster an understanding of the goals of the program, and the detailed methodologies used to accomplish those goals.

a. Equipment Calibration.

(1) The sampling contractor will follow an orderly program of positive actions to prevent the failure of equipment or instruments during use. This preventive maintenance and careful calibration helps to ensure accurate measurements from the field and laboratory instruments.

(2) All equipment that is scheduled for field use is cleaned and checked prior to calibration. Once the equipment has been calibrated, it is packed and stored to ensure the integrity of the equipment. An adequate supply of spare parts is taken to the field to minimize downtime due to equipment failure.

(3) Inspection and calibration of the equipment is a crucial step in ensuring the successful completion of the field effort. All equipment is inspected for proper operation and durability prior to calibration. Calibration of the following equipment is conducted in accordance with the procedures outlined in EPA documents entitled "*Quality Assurance Handbook for Air Pollution Measurement Systems; Volume III - Stationary Source Specific Methods,*" (EPA 600/4-77-027b), and 40 CFR Part 60 Appendix A. All calibrations will be performed prior to and at the conclusion of the test program. Documentation of all pretest calibrations will be kept in the project file during the field effort. Pretest and posttest calibrations will be provided in the Trial Burn Final Report. Copies of the equipment calibration forms can be found in Attachment A. The calibration procedures for the following equipment are summarized below.

(a) Probe Nozzles (QA Handbook, Vol III, Section 3.4.2, pp. 19) - average three internal diameter measurements of the nozzle; difference between high and low $\leq$ 0.1 mm. Recalibrate, reshape and sharpen when nozzle becomes nicked, dented or corroded.

(b) Pitot tubes (QA Handbook Vol III, Section 3.1.2, pp. 1-13) - measured for appropriate spacing and dimensions or calibrated in a wind tunnel. Rejection criteria given on the calibration sheet. A post-test check will inspect for damage.

(c) Thermocouples (QA Handbook, Vol III, Section 3.4.2, pp. 12-18) - verified against a mercury-in-glass thermometer at three points including the anticipated measurement range. Acceptance limits - impinger ± 2° F; dry gas meter ± 5.4° F; stack ± 1.5 percent of stack temperature.

(d) Dry gas meters (EPA 40 CFR Part 60, Method 5, Section 5.3) - calibrated against a wet test meter. Acceptance criteria - pretest $Y_i = Y \pm 0.02$; post test $Y_i = Y \pm 0.02$.

(e) Field barometer (QA Handbook, Vol III, Section 3.4.2, pp. 18-19) - compared against a mercury-in-glass barometer or use Deseret Weather Station BP and correct for elevation. Acceptance criteria - ± 0.02 inches Hg; post-test check will be the same.

(f) Analytical balances (QA Handbook, Vol III, Section 3.4.2, pp. 19) - Acceptance criteria - calibrated with standard Class-S weights are variable depending the rated range of the balance. Corrective action: Have manufacturer recalibrate or adjust.

b. Glassware Preparation.

(1) Sample train glassware and sample containers will require specialized precleaning to avoid contamination of the sample from the collection container or devices. Note that all bottle caps are fitted with Teflon™ liners that are cleaned in the same manner as the bottles themselves.

(2) Sample containers used for the process streams will be purchased pre-cleaned and sealed to specified EPA protocols.

(3) Cleaning and storage procedures for sample train glassware are summarized below:

(a) The Method 0023A sampling train glassware will be pre-cleaned with alconox soap and water wash. Deionized water will be used three times for rinsing followed by an acetone (3 times) and toluene (3 times) rinse and followed by acetone (3 times), then air dried. The glassware will then be sealed with toluene-rinsed aluminum foil.

(b) Method 0010 sampling train glassware will be pre-cleaned with alconox soap and water wash. Deionized water will be used three times for rinsing followed by a methanol (3 times) and methylene chloride (3 times) rinse, then air dried. The glassware will then be sealed with methanol/methylene chloride-rinsed aluminum foil.

(c) The Method 5i and combined M5i/M0050 sampling train glassware will be pre-cleaned using an alconox soap and water wash. Deionized water will be used for rinsing followed by air drying. The glassware will then be sealed with parafilm.

(d) The Method 0031 and 0040 sampling train glassware will be pre-cleaned with an alconox soap and water wash. Deionized water will be used for rinsing followed by oven drying at 130° C for two hours. The glassware will then be sealed with pre-cleaned aluminum foil. Sorbent traps will be prepared in accordance with the procedures called out in SW-846, Method 0031.

(e) The Method 0060 sampling train glassware will be pre-cleaned with an alconox soap and water wash. The glassware will then be rinsed three times with tap water, followed by three additional rinses with deionized water. The glassware will then be rinsed with a 10 percent nitric acid solution, then rinsed three times with deionized water and a final rinse with acetone. The glassware will then be air-dried and sealed with parafilm.

c. Sample Media Preparation.

(1) All reagents will be checked in accordance with the sampling contractor's existing QC Program to minimize the probability of using contaminated solvents. This includes the use of spectro-grade solvents from the same lot and the collection and analysis of the appropriate blanks. All filters will be desiccated and weighed to the nearest 0.5 mg constant weight.

(2) XAD resin used in the Method 0023A and Method 0010 sampling trains will be packed by the laboratory in specially designed sorbent traps. All glass cleaning and sorbent packing procedures, conducted by the laboratory, will follow the protocols specified in SW-846, Method 0010.

(3) The Method 0031 VOST traps will be conditioned by the laboratory in accordance with procedures called out in SW-846, Method 0031. Laboratory preparation steps will meet or exceed all QC requirements called out in the protocol.

4. Sampling Methods.

a. Onsite sampling activities will include the equipment staging in the field, sampling operations, data logging except where noted below, and sample recovery. Copies of field sampling data sheets can be found in Attachment B.

b. The MPF Trial Burn will consist of one baseline and three performance runs. Each performance run is expected to last approximately seven hours to accomplish six hours of actual sampling time. The expected samples and collection frequency are presented in Tables K-3-1 and K-3-2.

c. The MPF, which utilizes a batch feed system, will employ the following sampling start/stop scenario. Sampling will begin when the first TC has been moved to Zone 2 and the second TC is in position within Zone 1. The Test Director, or a designated representative, will authorize the sampling team leader to begin sampling. Sampling will continue through any incinerator abnormalities unless the waste feed cutoff system or unplanned shutdown (i.e., power failure) shuts the incinerator down. Because TCs are batch-fed to the furnace every 80 minutes, a modified waste feed cutoff approach will be necessary.

d. An AWFCO on the MPF will lock out the feed door, preventing any new burn TCs from entering Zone 1. Any uncombusted materials in the TCs within the combustion zones will continue combustion by the residual heat in the furnace and in the afterburner.

e. Sampling will stop upon activation of an AWFCO or shutdown of the MPF, but the probes will not need to be removed until instructed, based on the decision of the Test Director (or designee) and DSHW. In the event the probes are required to be removed from the stack, the probe locations will be marked, the probes removed, the trains leak checked, and the nozzles capped. Sampling will not resume until steady state conditions have been restored. Upon resumption of steady state, the sample probes will be uncapped, leak checked, and reinserted to the marked position. Sampling will begin after the Test Director has indicated the furnace is stabilized.

f. Sampling train problems will be analyzed on the spot by the sampling team leader and the CAMDS COR. If it can be shown that the sampling results are not significantly biased and the results may be valid, the run will continue. If the decision is made to abort a test run, the entire set of samples collected for that run may be discarded. The DSHW representative will be present onsite to review any problems that may arise.

5. EPA Methods 1 and 2 for Velocity Measurements and Cyclonic Flow.

a. Velocity traverses will be conducted at the sampling location with an S-type pitot assembly in accordance with EPA Method 1, *Sample Velocity Traverse for Stationary Sources,* and EPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)*, 40 CFR Part 60, Appendix A.

(1) An S-type pitot tube with an attached inclined manometer will be used to measure the gas velocities.

(2) An attached Type-K thermocouple with remote digital display will be used to determine the exhaust gas temperature.

(3) During the test program, velocity measurements will be conducted during each test run at the sampling location. The required number of velocity measurement points for each sampling location will be determined following EPA Method 1.

b. Cyclonic flow checks will be conducted at the sampling locations prior to sampling in accordance with Section 2.4 of EPA Method 1, 40 CFR Part 60, Appendix A. This procedure is referred to as the nulling technique.

(1) An S-type pitot tube connected to an inclined manometer will be used in this method. The pitot tube will be positioned at each traverse point so that the face openings of the pitot tube are perpendicular to the stack cross-sectional plane. This position is called the "0" reference."

(2) The velocity pressure (ΔP) measurement will be noted. If the ΔP reading is zero, the cyclonic angle is recorded as 0°. If the ΔP reading is not zero, the pitot tube is rotated clockwise or counterclockwise until the ΔP reading becomes zero. This angle is then measured with a leveled protractor and reported to the nearest degree.

(3) After this null technique is applied at each traverse point, the average of the cyclonic angles is calculated. If this average is less than 20°, the flow condition in the source is acceptable to test. This check will be performed on each isokinetic sampling location prior to testing.

6. EPA Method 3A for Flue Gas Molecular Weight. Oxygen and carbon dioxide concentrations will be determined using the facility CEMS, operated in accordance the CEMS Monitoring Plan. These data will be used to calculate the flue gas molecular weight for determining the volumetric flow rates, as well as providing the O_2 concentrations for correcting emission rates to 7% O_2.

7. EPA Method 4 for Moisture Determination. Although a separate Method 4 train will not be run, moisture will be determined for each test run according to EPA Method 4, *Determination of Moisture Content in Stack Gases,* 40 CFR Part 60, Appendix A. The principle of this method is to remove the moisture from the sample stream and determine moisture either volumetrically or gravimetrically. Method 4 will be used in conjunction with Methods 5i and 5i/0050, Method 0060, Method 0023A, and Method 0010 for the determination of moisture at the outlet of the MPF PAS system during each test run. The weight gain for each sample trains/impinger configuration will be recorded and used in the stack gas moisture determination calculation.

8. EPA Method 10 for Carbon Monoxide. Carbon monoxide will be determined for each test run according to EPA Method 10, *Determination of Carbon Monoxide Emissions from Stationary Sources*, 40 CFR Part 60, Appendix A, using the facility CEMS.

9. SW-846 Method 0023A for PCDDs/PCDFs.

a. A sampling train will be used to measure and determine the emission rate of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs) in accordance with SW-846 Method 0023A, *Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources*.

b. The sampling train consists of a heated, glass-lined probe with a glass button-hook nozzle. A thermocouple and S-type pitot tube with an inclined manometer will be attached to the probe for measurement of gas temperature and velocity. The sample gas passes through the probe assembly to a heated glass fiber filter. The filter holder will be maintained at 248 ± 25° F throughout each test period. Downstream of the heated filter, the gas passes through a water-cooled condenser module, then through a sorbent module containing approximately 25g of XAD-2 resin. The XAD module will be kept at a temperature at or below 68° C. The gas will then pass through a series of five ice-cooled impingers kept at or below 68° F to enable condensation of entrained moisture. The first impinger, acting as a condensate reservoir connected to the outlet of the XAD module, will be modified with a short stem so that the sample gas does not bubble through the collected condensate. The next two impingers each will contain 100 mL of deionized water. The fourth impinger will be empty and the fifth impinger will contain a pre-weighed amount of silica gel. All connections within the train will be glass or Teflon. No sealant greases will be used. The impingers will be followed by a dry gas meter, pump and calibrated orifice meter as presented in Figure K-3-1.

c. One Method 0023A sample will be collected for each performance run. Each sample will be collected over a six-hour period. Sampling will be isokinetic (10 percent) with readings of exhaust gas parameters recorded every five minutes during each sampling point of the traverses.

d. Leak checks of the entire Method 0023A sampling train will be performed before and after sampling in each of the two ports. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling, and following reassembly of, the train. All leak checks and leakage rates will be documented on the relevant field test data sheet. The acceptance criterion for the Method 0023A train is a leak rate of ≤0.02 cfm at the highest vacuum obtained during the run.

e. Following the completion of each test run, the Method 0023A sampling train probe and dissembled parts will be capped with Teflon™ tape and will be transported to a recovery area onsite. The sample recovery sequence will be as follows:

(1) Conduct post-test leak check on the sampling train.

(2) Remove the sampling train to the recovery area.

(3) Note the condition of the train (i.e., filter condition, impinger contents color, silica gel color, etc.).

(4) Disassemble the filter housing and transfer the filter to its original glass petri dish with hexane-rinsed forceps. Seal the container with Teflon™ tape and label it with the appropriate sample information.

(5) The front half of the train, nozzle, probe, sample line, and front-half and back-half filter housing, and condenser will be brush-rinsed with acetone. This will be followed by a methylene chlorine rinse and a final toluene rinse into the same amber glass container with a Teflon™-lined cap. The rinse procedures will be performed three times with each solvent after which the container will be sealed and labeled.

(6) The back half of the train, back-half of filter housing, condenser, and connecting glassware will be rinsed three times with acetone, followed by methylene chloride and toluene. The rinses will be placed into the same amber glass container with a Teflon™-lined cap. The container will then be sealed and labeled.

(7) The XAD-2 resin sorbent module will be tightly capped at both ends with Teflon™ tape and aluminum foil and labeled. The module will then be covered with aluminum foil and stored on ice for transport to the laboratory for analysis.

(8) The silica gel will be returned to its original container and weighed to obtain a final weight.

(9) All containers will be checked to ensure proper sealing, proper labeling and that all liquid levels are marked. All samples will then be logged onto the chain-of-custody record.

f. The Method 0023A train will result in the following samples:

(1) Filter

(2) XAD-2 Module
(3) Front-Half Acetone/Methylene Chloride/Toluene Rinse

(4) Back-Half Acetone/Methylene Chloride/Toluene Rinse

g. Reagent blanks will be collected and only analyzed if the field blank indicates that contamination of the reagents may be possible. A field blank will be prepared with the same components as a regular train and recovered using the same amount and type of reagents. The field blank train will be set up in the same manner as a field sample train. The probe and filter housing will be maintained at the same temperature as a field train and allowed to remain set up for the same duration as a field sample train. The field blank train will be leak checked the same number of times as a field train, and the probe will be capped between leak checks. The field blank train does not have to pass the leak check to be a valid field blank. The field blank will be recovered in the same manner as the field sample train. The recovered samples will be analyzed the same as the other trains.

10. SW-846 Method 0060 for Trace Metals.

a. Reagent blanks will be collected and only analyzed if the field blank indicates that contamination of the reagents may be possible. A field blank will be prepared with the same components as a regular train and recovered using the same amount and type of reagents. The field blank train will be setup in the same manner as a field sample train. The probe and filter housing will be maintained at the same temperature as a field train and allowed to remain setup for the same duration as a field sample train. The field blank train will be leaked checked the same number of times as a field train, and the probe will be capped between leak checks. The field blank train does not have to pass the leak check to be a valid field blank. The field blank will be recovered in the same manner as the field sample train. The recovered samples will be analyzed the same as the other trains

b. A sampling train for the determination of trace metals will be operated in accordance with SW-846 Method 0060, *Determination of Metals in Stack Emissions*. This train will be used to measure and determine the emission rates of arsenic (As), boron (B), cobalt (Co), copper (Cu), manganese (Mn), phosphorous (P), selenium (Se), tin (Sn), vanadium (V), zinc (Zn), barium (Ba), chromium (Cr, total), beryllium (Be), cadmium (Cd), lead (Pb), mercury (Hg), silver (Ag), thallium (Tl), antimony (Sb), nickel (Ni), and aluminum (Al).

c. The sampling train will consist of a heated glass-lined probe with a glass buttonhook nozzle. A thermocouple and S-type pitot tube with an inclined manometer will be attached to the probe for the measurement of gas temperature and velocity measurement. The sample gas passes through the probe assembly to a heated glass fiber filter. The filter holder will be maintained at 248 $\pm$ 25° F throughout all test runs. Downstream of the heated filter, the sample gas passes through a series of seven ice-cooled impingers kept at or below 68° F to enable condensation of entrained moisture. The first impinger is essentially a moisture knockout and will be empty. The second and third impingers will contain 100 mL of a 5% HNO_3/10% H_2O_2 solution. The fourth impinger will be empty. The fifth and sixth impingers will contain 100 mL of a 4% $KMnO_4$/10% H_2SO_4 solution. The seventh impinger will contain a pre-weighed amount of silica gel. The impingers will be followed by a dry gas meter, pump, and calibrated orifice meter as presented in Figure K-3-2.

d. One Method 0060 sample will be collected for each performance run. Each sample will be collected over a two-hour period. Sampling will be isokinetic (10 percent) with readings of exhaust gas parameters recorded every five minutes during each sampling point of the traverses.

e. Leak checks of the entire Method 0060 sampling train will be performed before and after sampling in each port. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling, and following reassembly of, the train. All leak checks and leakage rates will be documented on the relevant field test data sheets. The acceptance criterion for the Method 0060 train is a leak rate of 0.02 cfm at the highest vacuum obtained during the test run.

f. Following the completion of each test run, the Method 0060 train, probe and dissembled parts will be capped with Teflon™ tape and will be transported to a recovery area onsite. The sample recovery sequence will be as follows:

(1) Conduct post-test leak check on the sampling train.

(2) Remove the sampling train to the recovery area.

(3) Note the condition of the train (i.e., filter, impinger contents color, silica gel color, etc.).

(4) Disassemble the filter housing and transfer the filter to its original glass petri dish. Seal the petri dish with Teflon™ tape and label it with the appropriate sample information.

(5) The front-half of the train, nozzle, probe and front-half filter housing will be brush-rinsed with 100 mL of 0.1N nitric acid into an amber glass container with a Teflon™-lined cap. The container will be sealed and labeled.

(6) The contents of the first three impingers will be measured for volume and transferred to a glass amber container with a Teflon™-lined cap. The impingers, back-half filter housing, right angle, and U-tubes will be rinsed with 100 mL of 0.1N nitric acid into the sample container. The container will be sealed and labeled.

(7) The contents of the fourth impinger will be measured for volume and transferred to a glass amber container with a Teflon™-lined cap. The impinger and U-tubes will be rinsed with 100 mL of 0.1N nitric acid into a sample container. The container will be sealed and labeled.

(8) The contents of the fifth and sixth impingers will be measured for volume and transferred to a glass amber container with a Teflon™-lined cap. The impingers and U-tubes will be rinsed with 100 mL of an acidified potassium permanganate solution combined in the sample container. The impingers and U-tubes will also be rinsed with 100 mL of deionized water into the same container. The container will then be sealed and labeled.

(9) If deposits are present, the fifth and sixth impingers and connecting U-tubes will be rinsed with 25 mL of 8N HCl into a sample container containing 200 mL of deionized water. The container will be sealed and labeled.

(10) The silica gel will be returned to its original container and weighed to obtain a final weight.

(11) All containers will be checked to ensure proper sealing, proper labeling and that all liquid levels are marked. All samples will be logged onto a chain-of-custody record.

g. The Method 0060 train will produce the following samples:

(1) Filter

(2) Front-half 0.1N nitric acid rinse

(3) Back-half nitric/H_2O_2 impinger catch and rinse

(4) Impinger 4 - 0.1N nitric acid rinse

(5) Impingers 5 and 6 - $KMnO_4$ impinger catch

(6) 8N HCl rinse

h. Reagent blanks will be collected and analyzed. A field blank will be prepared with the same components as a regular train and recovered using the same amount and type of reagents. The field blank train will be set up in the same manner as a field sample train. The probe and filter housing will be maintained at the same temperature as a field train and allowed to remain set up for the same duration as a field sample train. The field blank train will be leak checked the same number of times as a field train, and the probe will be capped between leak checks. The field blank train does not have to pass the leak check to be a valid field blank. The field blank will be recovered in the same manner as the field sample train. The recovered samples will be analyzed the same as the other trains.

11. SW-846 Method 0010 for Semivolatile Organics.

a. A sampling train will be used to measure and determine the emission rate of the semivolatile products of incomplete combustion (PICs) in accordance with SW-846 EPA Method 0010, *Modified Method 5 Sampling Train*. The target analytes are presented in Table K-4-5 (page K-58). The sampling train consists of a heated glass-lined probe with a stainless steel or glass button-hook nozzle. A thermocouple and S-type pitot tube will be attached to the probe for measurement of gas temperature and velocity measurement. The sample gas passes through the probe assembly to a heated glass fiber filter. The filter holder will be maintained at 248° F 25° F throughout each test period. Downstream of the heater filter, the gas passes through a water-cooled condenser module, then through a sorbent module containing approximately 25g of XAD-2 resin. The XAD module will be kept at a temperature at or below 68° F. The gas will then pass through a series of five ice-cooled impingers kept at or below 68° F to enable condensation of entrained moisture. The first impinger, acting as a condensate reservoir connected to the outlet of the XAD module, will be modified with a short stem so that the sample gas does not bubble through the collected condensate. The next two impingers will each contain 100 mL of deionized water. The fourth impinger will be empty and the fifth impinger will contain a pre-weighed amount of silica gel. All connections within the train will be glass or Teflon™. No sealant greases will be used. The impingers will be followed by a dry gas meter, pump and calibrated orifice meter as presented in Figure K-3-3.

b. The sampling contractor will collect one Method 0010 sample for each performance run. Each sample will be collected over a six-hour period. Sampling will be isokinetic (10 percent) with readings of exhaust gas parameters recorded every five minutes during each sampling point of the traverses.

c. Leak checks of the entire Method 0010 sampling train will be performed before and after sampling in each port. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling, and following reassembly of, the train. All leak checks and leakage rates will be documented on the relevant field test data sheet. The acceptance criteria for the Method 0010 train is a leak rate of 0.02 cfm at the highest vacuum obtained during the run.

d. Following the completion of each test run, the Method 0010 train, probe and dissembled parts will be capped with Teflon™ tape and transported to a recovery area onsite. The sample recovery sequence will be as follows:

(1) Conduct post-test leak check on the sampling train.

(2) Remove the sampling train to the recovery area.

(3) Note the condition of the train (i.e., filter condition, impinger contents color, silica gel color, etc.).

(4) Disassemble the filter housing and transfer the filter to its original glass petri dish with hexane-rinsed forceps. Seal the container with Teflon™ tape and label it with the appropriate sample information.

(5) The front half of the train, nozzle, probe, sample line, and front-half filter housing will be brush-rinsed with 1:1 methanol/methylene chloride into the same amber glass container with a Teflon™-lined cap. The rinse procedure will be performed three times with each solvent after which the container will be sealed and labeled.

(6) The XAD-2 resin sorbent module will be tightly capped at both ends with Teflon™ tape and aluminum foil and labeled. The module will then be covered with aluminum foil and stored on ice for transport to the laboratory for analysis.

(7) The contents of the first four impingers will be measured for volume and transferred to a pre-cleaned glass amber container.

(8) The back-half of the train, back-half filter housing, condenser, impingers and U-tubes will be brush-rinsed with 1:1 methanol/methylene chloride into the same amber glass container with a Teflon™-lined cap. The rinse procedure will be performed three times after which the container will be sealed and labeled.

(9) The silica gel will be returned to its original container and weighed to obtain a final weight.

(10) All containers will be checked to ensure proper sealing, proper labeling and that all liquid levels are marked. All samples will then be logged onto the chain-of-custody record.

e. The Method 0010 train will result in the following samples:

(1) Filter

(2) XAD-2 Module

(3) Front-Half Methanol/Methylene Chloride Rinse

(4) Impinger Condensate

(5) Back-Half Methanol/Methylene Chloride Rinse

f. Reagent blanks will be collected and analyzed only if the field blank indicates that the reagent may be contaminated. A field blank will be prepared with the same components as a regular train and recovered using the same amount and type of reagents. The field blank train will be set up in the same manner as a field sample train. The probe and filter housing will be maintained at the same temperature as a regular sample train and allowed to remain set up for the same duration as a sample train. The field blank train will be leak checked the same number of times as a field train, and the probe will be capped between leak checks. The field blank train does not have to pass the leak check to be a valid field blank. The field blank will be recovered in the same manner as the field sample train. The recovered samples will be analyzed the same as the other trains.

12. SW-846 Method 0031 for Volatile Organics.

a. SW-846 Method 0031, Sampling Method for Volatile Organic Compounds (SMVOC), will be used to sample exhaust gas for the determination of volatile organic compounds. The target analytes are presented in Table K-4-3 (page K-56). The SMVOC draws exhaust gas through a set of three sorbent traps. Four sets of traps will be collected per run. Sampled gas will be passed through each set of traps for 40 minutes at the rate of 0.5 lpm (slow-SMVOC). The 4 sets of tubes will be analyzed for each run to represent 160 minutes of actual sampling time during each performance run. The collection of the 4 sets of traps will be evenly spaced over the sampling run.

b. Figure K-3-4 presents a schematic of this sampling train. The SMVOC probe removes exhaust gas from the duct while the probe temperature is at a minimum of 130° C (266° F) during sampling. The exhaust gas passes through a condenser and the first two traps each containing about 1.6 grams of Tenax™ resin. The exhaust gas then passes through a knockout flask that collects condensed water. The gas passes through a second condenser and through the third trap containing approximately 5 grams of Anasorb™ –747. Each water-cooled condenser is arranged so that condensate will drain vertically through the traps. The traps are arranged in series so the majority of the compounds will be trapped on the Tenax™. The Anasorb™ –747 in the third trap will retain the gaseous compounds. New Teflon™ sample transfer lines will be used for the tests and the sampling train will use greaseless fittings and connectors. The exhaust gas will be sampled at approximately 0.5 L per minute (20 L per sample). Analyses of the SMVOC tubes will follow SW-846, Method 5041A. In

c. In the event of high PIC concentrations, it may be necessary to conduct the analyses using a bag dilution technique developed by the laboratory.

d. The condensate collected from the knock-out flask in the SMVOC will have the volume measured and a portion transferred to a 40-mL Volatile Organic Analysis (VOA) vial with a Teflon-lined septum. The condensate will be analyzed for volatile organic compounds according to Method 8260B. Leak checks of the entire Method

0031 sampling train will be performed before and after sampling each tube set. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling, and following reassembly of, the train. All leak checks and leakage rates will be documented on the relevant field test data sheet.

e. The SMVOC tubes will be purchased pre-cleaned and pre-conditioned. The tubes contain gas chromatography quality Tenax™ and Anasorb™-747 and they will be used without further cleanup. The tubes will meet the "blank" criteria and will be consistent with the requirements of the method. The supplier will provide an analysis for each batch of SMVOC tubes used.

f. Extra sorbent cartridges will be taken to the sampling site to serve as field blanks. One set of SMVOC tubes, designated as a field blank, will be removed from their containers and exposed to ambient air for the same amount of time it takes to attach the cartridges to the sampling train. The caps will then be replaced. This procedure is repeated for every tube change. The field blank will be capped and stored for transport in the same manner as the sample-exposed cartridges. The field blanks will be analyzed by the same method as the actual samples. The SMVOC tubes will be stored separately from other samples both before and after sampling to minimize the potential for contamination.

13. EPA Method 5i for Particulate Matter and PM_{10}

a. The sampling and analytical procedures outlined in EPA 40 CFR Part 60, Appendix A, Method 5i will be used to determine particulate matter. The assumption will be made that all collected particulate matter is PM_{10} as a worst-case scenario and will fulfill the requirement to determine and report the system's particulate and PM_{10} emissions. The nozzle and probe liner will be constructed of borosilicate glass or quartz. A 47 mm filter holder will be constructed of borosilicate glass with a Teflon™-coated stainless steel filter support and a Viton O-ring. A quartz-fiber or Teflon™ mat filter will be used. The filter assembly will be weighed as a complete package before sampling and after desiccating as directed in Method 5i. Nozzles, probe liners, and filter holders will be rinsed thoroughly prior to testing. Samples will be collected for a period of two hours. Figure K-3-5 presents a schematic of this train.

b. This train will be run in duplicate, with both trains being operated simultaneously. One of the trains will be assembled using Method 0050 train reagents in the back half impingers for the collection and subsequent analysis of HCl and Cl_2. The M5i and M0050 trains are operated identically, allowing this combination. Section III-14 (page K-23) describes the setup of the M5i/M0050 train and its recovery. The operation of the 5i trains is as follows:

c. The sample is withdrawn isokinetically from the exhaust gas. The temperature of the sample probe and the filter housing will be 248 ± 25° F. The sampling runs will be performed within ±10 percent of isokinetic conditions. Sampling will be isokinetic (±10 percent) with readings of exhaust gas parameters recorded every five minutes during sampling.

d. Leak checks of the entire Method 5i sampling train will be performed before and after sampling in each port. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling, and following reassembly of, the train. All leak checks and leakage rates will be documented on the relevant field test data sheet. The acceptance criteria for the Method 5i train is a leak rate of ≤0.02 cfm at the highest vacuum obtained during the run.

e. Following the completion of each test run, the Method 5i train, probe, and dissembled parts will be capped with Teflon tape and transported to a recovery area onsite. The probe of both M5i trains will be brush-rinsed three times with acetone and the rinses placed in an amber glass container, labeled and sealed. The rinse and the material collected in the filter housing will be used to determine the PM emissions for RCRA and air permit purposes. The front half rinses are not required by the method to be cooled; therefore, the acetone samples recovered from this train will not be cooled as a preservative step.

f. The impingers used in the second M5i train are as follows (note that the train setup and recovery of the combined M5i/0050 train are discussed in the following section):

(1) Impingers 1 & 2: Greenburg-Smith impingers containing 100 mL of DI H_20

(2) Impinger 3: modified Greenburg-Smith impinger, empty

(3) Impinger 4: modified Greenburg-Smith impinger containing silica gel.

g. The impinger contents will be measured at the conclusion of the run. This train will result in the following samples:

(1) Filter assembly

(3) Front-half acetone rinse.

h. Reagent blanks will be analyzed. Because of the redundancy in M5i sample trains, the combined M5i/M0050 field blank train will be prepared and recovered as described in Section III-14 below.

14. EPA Method 5i/0050 for Particulate Matter/PM_{10}/Hydrogen Chloride/Chlorine.

a. The sampling and analytical procedures outlined in EPA Methods 5i and Method 0050 will be used to determine particulate matter, HCl, and Cl2 emissions. The assumption will be made that all collected particulate matter is PM10 as a worst-case scenario and will fulfill the requirement to determine and report the system's particulate and PM10 emissions. The nozzle and probe liner will be constructed of borosilicate glass or quartz. A 47 mm filter holder will be constructed of borosilicate glass with a Teflon-coated stainless steel filter support and a Viton O-ring. A quartz-fiber or Teflon™ mat filter will be used. The filter assembly will be weighed as a complete package before sampling and after desiccating as directed in Method 5i. Nozzles, probe liners, filter holders, and impingers will be rinsed thoroughly prior to testing. Samples will be collected for a period of two hours. Figure K-3-6 presents a schematic of the Method 5i/0050 sampling train.

b. The sample is withdrawn isokinetically from the exhaust gas. The temperature of the sample probe and the filter housing will be 248 ± 25° F. The sampling runs will be performed within 10% of isokinetic conditions. Sampling will be isokinetic (10 percent) with readings of exhaust gas parameters recorded every five minutes during sampling.

c. Leak checks of the entire Method 5i/0050 sampling train will be performed before and after sampling in each port. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling, and following reassembly of, the train. All leak checks and leakage rates will be documented on the relevant field test data sheet. The acceptance criteria for the Method 5i/0050 train is a leak rate of $\leq$0.02 cfm at the highest vacuum obtained during the run.

d. Following the completion of each test run, the Method 5i/0050 train probe and dissembled parts will be capped with Teflon tape and be transported to a recovery area onsite. In accordance with Methods 5i and 0050, the front half acetone and filter assembly will be recovered for determination of particulate matter (and PM_{10}) emissions and the back half impinger catches will be recovered for determination of HCl and Cl_2 emissions. The front-half rinse and filter sample fractions are not required by the method to be cooled; therefore, those samples recovered from this train may not be cooled as a preservative step. The contents of impingers 1 and 2 will be placed into a polyethylene bottle and the impingers, back half of the filter housing, and connecting glassware will be rinsed three times with deionized water with the rinses being placed into the same container as the contents of impingers 1 and 2. The container will be labeled and sealed. The contents of impingers 3 and 4 will be placed into another polyethylene sample container and the impingers and connecting glassware will then be rinsed in the same manner as impingers 1 and 2.

e. The samples recovered from this train are as follows:

(1) Filter assembly

(2) Front-half acetone rinse

(3) Impingers 1 and 2 containing 0.1 N H_2SO_4, condensate, and rinses

(4) Impingers 3 and 4 containing 0.1 N NaOH, condensate, and rinses

(5) Impinger 5 containing silica gel.

f. The front half M5i components and acetone rinses will be analyzed gravimetrically in accordance with the method. Ion chromatography (IC) will be used to analyze the impinger solutions. The HCl emissions will be determined from the analysis of the H_2SO_4 impinger solutions. The chlorine emissions are determined from the analysis of the NaOH impingers. Chlorine is absorbed by the basic solution and disassociates to form sodium chloride and sodium hypochlorite (NaOCl). The sample recovery of the NaOH impingers will include the addition of sodium thiosulfate to reduce any NaOCl to chloride ion. This will result in two moles of chloride ion for each mole of chlorine present in the exhaust gas sample.

g. Reagent blanks will be analyzed. A field blank will be prepared with the same components as a regular train and recovered using the same amount and type of reagents. The recovered samples will be analyzed the same as the other trains Reagent blanks will be collected and analyzed. A field blank will be prepared with the same components as a regular train and recovered using the same amount and type of reagents. The field blank train will be set up in the same manner as a field sample train. The probe and filter housing will be maintained at the same temperature as a sample train and allowed to remain set up for the same duration as the sample train. The field blank train will be leak checked the same number of times as a sample train, and the probe will be capped between leak checks. The field blank train does not have to pass the leak check to be a valid field blank. The field blank will be recovered in the same manner as the sample train. The recovered samples will be analyzed the same as the other trains.

15. SW-846 Method 0040 and Method 0010 for Total Organics.

a. Two sampling trains will be used to measure and determine the emission rates of volatile, semivolatile and nonvolatile organic compounds in accordance with the draft EPA method entitled, "*Guidance for Total Organics - Final Report, March 1996*". This guidance document describes the use of SW-846 Method 0040 for determining total volatile organics and SW-846 Method 0010 for determining total semivolatile and nonvolatile organics.

b. The methods provide for the sampling and analysis of total organics from stack gas emissions, combining the organics from three specific boiling point/vapor pressure ranges: light hydrocarbons and volatile organics; semivolatile organics; and nonvolatile organics. Two sampling procedures and four analytical techniques will be combined to generate a value for total organics. The mass of organics that remains after correction for the identified organics from SW-846 methodologies is called residual organic carbon. This mass is used in estimating risk from unidentified organic emissions.

16. Method 0040 for Total Volatile Organics.

a. A detailed schematic of the principal components of the SW-846 Method 0040 sampling train for total volatile organics is shown in Figure K-3-7.

b. The sampling train consists of a glass-lined probe, a heated glass or Teflon™ filter holder and quartz filter attached to one of two inlets of a glass/Teflon™ 3-way isolation valve. The second valve inlet is connected to a charcoal trap to filter incoming air when releasing system pressure after leak checks. The outlet of the isolation valve is connected to a glass, water-cooled, coil-type condenser and a glass condensate trap for removal and collection of condensable liquids present in the gas stream. A 1/4-inch OD x 1/8-inch ID Teflon™ transfer line connects the condensate trap to a second 3-way isolation valve and the isolation valve to a Tedlar bag contained in a rigid, air-tight container for sampling, storage and transport. The bag container is connected to a control console with 1/4-inch OD x 1/8-inch ID vacuum line between the bag container and the control console to protect the console and sampling personnel from hazardous emissions in case of a bag rupture during sampling.

c. Leak checks of the entire Method 0040 train will be performed before and after each sampling run. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling the train. All leak checks and leakage rates will be documented on the relevant field test data sheets.

d. Three Tedlar bag flue gas samples will be collected per test run with approximately 22 liters of sample collected in a 25-liter Tedlar bag at a flow rate of approximately 0.35 L/min. One of these samples is used as the field control spike described below. A field blank will also be collected during each test run. The field blank will consist of attaching a Tedlar bag containing either air or nitrogen to the sample probe and collecting approximately 22 liters of air or nitrogen into a 25-liter Tedlar bag. Each test run will produce the following samples:

(1) Run 1 Tedlar bag sample 1

(2) Run 1 Condensate sample 1

(3) Run 1 Tedlar bag sample 2

(4) Run 1 Condensate sample 2

(5) Run 1 Tedlar bag sample 3 (field control spike)

(6) Run 1 Tedlar bag field blank

(7) Run 1 Condensate field blank

e. During one of the test runs, a field control spike will be conducted. A field control spike consisting of known concentrations of target compounds (methane through heptane) will be injected directly into the Tedlar bag during the collection of a third field sample. The concentrations will be within the calibration range of the GC, usually around 15 ppm, and the recovery of the spikes must meet the 80 to 120% criteria. The field control sample replaces one of the field samples collected during a test run.

f. During the Trial Burn program a field control sample will be collected. This sample consists of a Tedlar bag containing known concentrations of target compounds . The Tedlar bag is attached to the sampling probe. Approximately 22 liters of the field control sample contained in the bag will be drawn through the sampling train and collected in a 25-liter Tedlar bag. This field control sample test run will produce the following samples:

(1) Run 1 Tedlar bag field control sample

(2) Run 1 Condensate field control sample

g. Post-Test Procedures:

(1) Record the final volume from the dry gas meter at the end of each sample collection period.

(2) Perform a post-test leak check.

(3) Inspect the field sampling data form and sample identification labels for accuracy and completeness.

(4) Replace the particulate filter after each sample.

(5) Condensate Recovery: The condensate collected during sampling must be recovered separately for each individual bag sample collected, using the following procedures:

(a) Carefully remove the condensate trap, the condenser and the sample line (from the trap to the bag) from the sample train. Pour the contents of the condensate trap into a clean measuring cylinder.

(b) Rinse the condenser, the condensate trap and the sample three times with 10 mL of HPLC grade water and add the rinsings to the measuring cylinder containing the condensate. Record the final volume of the condensate and rinse mixture on the field sampling data form. High moisture sources (such as those with wet control devices) may require a 150 mL or 200 mL measuring cylinder while low moisture sources (such as some rotary kilns and pyrolytic incinerators) may require only a 100 mL size.

(c) Pour the contents of the measuring cylinder into a 20 mL or 40mL amber glass VOA vial with a Teflon septum screw cap. Fill the vial until the liquid level rises above the top of the vial and cap tightly. The vial should contain zero void volume (i.e., no air bubbles). Discard any excess condensate into a separate container for storage and transport for proper disposal.

(6) Label each vial by using wrap around labels. Labels can be preprinted or can be filled out onsite.

(7) Submit to laboratory for purge and trap GC/FID analysis.

17. Method 0010 for Total Semi/Nonvolatile Organics.

a. A detailed schematic of the SW-846 Method 0010 total semivolatile and nonvolatile organics sampling train is shown in Figure K-3-8. The total semivolatile and nonvolatile sampling train is operated as a Method 0010 train and consists of a heated glass-lined probe with a glass button-hook nozzle. A thermocouple and S-type pitot tube will be attached to the probe for measurement of gas temperature and velocity. The sample gas passes through the probe assembly to a heated glass fiber filter. The filter holder will be maintained at 24825° F throughout each test period. Downstream of the heater filter, the gas passes through a water-cooled condenser module, then through a sorbent module containing approximately 25g of XAD-2 resin. The XAD module will be kept at a temperature below 20° C.

b. The gas will then pass through a series of ice-cooled impingers kept below at or 68° F to enable condensation of entrained moisture. The first impinger, acting as a condensate reservoir connected to the outlet of the XAD module, will be modified with a short stem so that the sample gas does not bubble through the collected condensate. The next two impingers each will contain 100 mL of deionized water. The fourth impinger will be empty and the fifth impinger will contain a pre-weighed amount of silica gel. All connections within the train will be glass or Teflon™; no sealant greases will be used. The impingers will be followed by a dry gas meter, pump and calibrated orifice meter.

c. One Method 0010 semivolatile and nonvolatile total organics sample will be collected over a six-hour period during each performance run. Sampling will be isokinetic (10 percent) with readings of exhaust gas parameters recorded every five minutes during sampling.

d. Leak checks of the entire sampling train will be performed before and after sampling in each port. In the event any portion of the train is disassembled and reassembled, leak checks will be performed prior to disassembling, and following reassembly of, the train. All leak checks and leakage rates will be documented on the relevant field test data sheet. The acceptance criteria for the train is a leak rate of 0.02 cfm at the highest vacuum obtained during the run.

e. Following the completion of each test run, the Method 0010 train probe and dissembled parts will be capped with Teflon tape and be transported to a recovery area onsite. The sample recovery sequence will be as follows:

(1) Conduct post-test leak check on the sampling train.

(2) Remove the sampling train to the recovery area.

(3) Note the conditions of the train (i.e., filter condition, impinger contents color, silica gel color, etc.).

(4) Disassemble the filter housing and transfer the filter to its original glass petri dish with hexane rinsed forceps. Seal the container with Teflon™ tape and label it with the appropriate sample information.

(5) The front half of the train, nozzle, probe, sample line, and front-half filter housing will be brush-rinsed with 1:1 methanol/methylene chloride into an amber glass container with a Teflon™-lined cap. The rinse procedure will be performed three times after which the container will be sealed and labeled.

(6) The XAD-2 resin sorbent module will be tightly capped at both ends with glass dead ends and labeled. The module will then be covered with aluminum foil and stored on ice for transport to the laboratory for analysis.

(7) The contents of the first four impingers will be measured for volume and transferred to a pre-cleaned glass amber container.

(8) The back-half of the train, back-half filter housing, condenser, impingers and U-tubes, will be brush-rinsed with 1:1 methanol/methylene chloride into an amber glass container with a Teflon-lined cap. The rinse procedure will be performed three times after which the container will be sealed and labeled.

(9) The silica gel will be returned to its original container and weighed to obtain a final weight.

(10) All containers will be checked to ensure proper sealing, proper labeling and that all liquid levels are marked. All samples will then be logged onto the chain-of-custody record.

f. The Method 0010 total semivolatile and nonvolatile organics train will result in the following samples:

(1) Filter

(2) XAD-2 Module

(3) Front-Half Methanol/Methylene Chloride Rinse

(4) Impinger Condensate

(5) Back-Half Methanol/Methylene Chloride Rinse

g. Reagent blanks will be collected and analyzed only if the field blank indicates contaminated reagents. A field blank will be prepared with the same components as a regular train and recovered using the same amount and type of reagents. The field blank train will be set up in the same manner as a field sample train. The probe and filter housing will be maintained at the same temperature as a field train and allowed to remain set up for the same duration as a field sample train. The field blank train will be leak checked the same number of times as a field train, and the probe will be capped between leak checks. The field blank train does not have to pass the leak check to be a valid field blank. The field blank will be recovered in the same manner as the field sample train. The recovered samples will be analyzed the same as the other trains.

18. Tap Sampling Method S004 for Liquid Samples.

a. Sampling of the liquid process samples will be conducted in accordance with EPA Method S004 *Sampling and Analysis Methods for Hazardous Waste Combustion.*

b. Liquid samples will be collected by CAMDS personnel under the direction of the sampling contractor by means of tap and line sampling procedures. A sample line is attached to the tap and inserted in the sample container. The tap is opened so that the sample fill time exceeds one minute. According to the method, the sampling tap is opened and the line and bottle flushed with the stream to be sampled. The flush is discarded into a container and managed appropriately. The specified sub-sample is collected. This ensures that the actual material collected is representative of the stream. Separate sub-sample bottles are used for each sample.

c. Grab samples will be collected during each test run to ensure that the samples are representative of conditions for each run. Frequency of sampling is addressed in Section II, page K-3.

d. Upon receiving custody of the process stream samples, sampling personnel will package all of the samples in the appropriate containers. All samples will be stored at reduced temperatures in a refrigerated cooler and then shipped on ice.

19. Sampling for Solid Samples.

a. Samples of the TC residue will be collected by CAMDS personnel under the direction of the sampling contractor by means of a stainless steel scoop. MPF ash samples will be collected directly from the TCs after exiting the secondary chamber and the ash has been allowed to cool.

b. Upon receiving custody of the solid process stream samples, the sampling contractor will package all of the samples in the appropriate containers. All samples will be stored at reduced temperatures in a refrigerator or cooler and then shipped on ice. The samples will be submitted to the laboratory for the analysis of VOCs, SVOCs, PCDDs/PCDFs, trace metals, and trace metals by the TCLP procedure.

20. Post Sampling Activities. Wastes generated during sample collection will be handled in a safe manner. Like waste materials, (such as acids or solvents) generated during sampling train cleaning or recovery will be placed in labeled waste containers (acid wastes, solvent wastes) prior to relinquishing to facility waste personnel.

21. Sample Preservation.

a. The sample preservation requirements and holding times are presented in Table K-3-3. The sampling and packaging technicians will preserve the samples as directed in Table K-3-3.

b. Samples requiring acidification will have acid added during sample collection. Samples of the brine and NaOH solution will not be acidified in the field due to the large volume of acid necessary to acidify these samples.

c. Sample temperatures are to be monitored upon receipt at the laboratory for those samples requiring cooling.

d. Holding times will be monitored by keeping track of the days since the samples were taken. Samples will be delivered or shipped to the laboratory as necessary to meet the holding times for the sample analyses.

22. Documentation. The following subsections present the requirements for maintaining the COC, labeling, and handling of environmental samples as well as recording practices necessary for reconstruction of the sampling event. Entries made on the following documents will use the following error correction protocol: one line through the error and initial and date the change. Documentation will be made conveniently available to DSHW upon request.

23. Chain-of-Custody Forms.

a. To establish the documentation necessary to trace sample possession from the time of collection, a COC record must be filled out and must accompany every sample or group of individually identified samples.

b. The COC for the sampling trains will be established when the recovered fractions are sealed with custody tape at the sample recovery laboratory. Before that time, a Sample Collection Form (SCF) will be used to trace control of the sample components. Examples of the SCF and COC forms can be found in Attachment B. When the sampling crew takes possession of the sample train components, an SCF will be started. The entire sampling crew handling the train may be listed on the SCF for that sample train or just one person. The person recording information on the field data sheet will take responsibility of the sample and sign the SCF for the sample when it reaches the sampling location. The person or persons transporting the sampling train to the sample recovery laboratory will sign the SCF. When the sample train reaches the recovery laboratory, the sample fractions will be checked in by the laboratory chemist and the chemist will sign the SCF when he accounts for each fraction. The laboratory chemist will then begin the COC when the fractions have been correctly recovered, labeled, and sealed.

c. The COC for the process samples will be filled out at the end of each performance run. Before that point, the samples will remain in the possession of the person collecting the samples. The samples may be secured in a cooler with COC tape on the cooler until the test run is completed. The samples will be secure due to the fact the samples are in a high security facility. Personnel in the area must have a security clearance or escorted by a security-cleared person before they are allowed within the double fenced area. Only personnel authorized by CAMDS are allowed into the areas where the samples are being collected. At the end of each test run, the samples will be transported to the sampling contractor field office/laboratory and stored in a locked refrigerator or locked cooler and held until shipment to the laboratory. The sampling contractor field office/laboratory will be locked and the coolers and/or refrigerators will be secured with a custody seal when sampling contractor personnel are offsite. Transfer of samples will be documented on the chain-of-custody form.

d. Each person who has custody of the samples must sign the COC form, which must contain the following information:

(1) Sample identification number

(2) Date and time of sample collection

(3) Signature or initials of sample collector

(4) Matrix type

(5) Number of containers

(6) Signatures of persons in the COC

(7) Date and time of each change in custody

24. Sample Labels.

a. Sample labels are necessary to prevent misidentification of samples. Gummed paper labels or tags will be used and will include at least the following information:

(1) Sample number including a sample code that distinguishes field samples, duplicates, or blanks where appropriate. The laboratory should not be cognizant of the code.

(2) Signature or initials of sample collector.

(3) Date and time of collection.

(4) Incinerator designator and trial run number.

(5) Type of preservative used, or "None," as applicable.

b. Labels will be affixed to sample containers prior to or at the time of sampling. The labels will be filled out at the time of sample collection.

25. Sample Seals. Sample seals are used to detect improper handling of samples from the time of sample collection through the time of analysis. Items such as gummed paper seals and custody tape will be used for this purpose. Signed and dated seals will be attached so that they must be broken to open either the individual sample containers or shipping containers. Seals will be affixed to containers before the samples leave the custody of the sampling personnel.

26. Logbook.

a. Information pertinent to sampling will be recorded in a sampling logbook. The logbook shall be bound, with consecutively numbered pages. All entries will be made in indelible ink and all corrections will follow the error correction protocol of one line through the error and initial and date of correction. Sampling personnel will also record all information on the appropriate sampling forms.

b. At a minimum, entries in a logbook for the exhaust gas samples shall include the following:

(1) Purpose of sampling

(2) Location and description of the exhaust gas sampling ports and the sampling points for the process samples.

(3) Documentation of procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., reagents in impingers)

(4) Identification of sampling crew members

(5) Type of samples collected

(6) Sampling methodology

(7) Date and times of sampling events

(8) General observations

(9) Deviations from the sampling methods

27. Sample Transport to the Laboratory. Samples will be packaged and shipped according to U.S. Department of Transportation, International Air Transportation Authority, and EPA regulations. Samples will be delivered to the laboratory so that the requested analyses can be performed within the specified allowable holding time. Samples will be accompanied by the COC record and by a sample analysis request form. The request form will list the variables to be analyzed by the laboratory and the total number and type of samples shipped for analysis. Authorized laboratory personnel will acknowledge receipt of shipment by signing and dating the COC form and returning a copy to the Field QC Coordinator.

Table K-3-1. Exhaust Gas Sampling Summary

SAMPLING TRAIN	ANALYSES PERFORMED	SAMPLING METHOD REFERENCE	TOTAL NUMBER OF SAMPLES COLLECTED DURING MPF SURROGATE TEST BURN (3~~7~~ RUNS TOTAL~~, INCL. BASELINE~~)
M1	Traverse Points	40 CFR 60, Appendix A	1 determination
M2	Duct Velocity	40 CFR 60, Appendix A	With each isokinetic train
M4	Exhaust Gas Moisture	40 CFR 60, Appendix A	With each isokinetic train
Method 5i	PM	40 CFR 60, Appendix A	6~~14~~ sample sets, plus one field blank (2 sample trains run in duplicate)
Method 9	Opacity	40 CFR 60, Appendix A	3~~7~~ sets of readings
Method 0023A	PCDD/PCDF	SW-846, Method 0023A	3~~7~~ sample sets plus one field blank
Method 0010	SVOCs	SW-846, Method 0010	3~~7~~ sample sets plus one field blank
Method 0010	SVTOC and NVTOC	SW-846, Method 0010	3~~7~~ sample sets plus one field blank
Method 0031	Volatile Organic Compounds	SW-846, Method 0031	12~~28~~ tube sets plus 3~~7~~ field blank sets and 2 trip blank sets
Method 0040	VTOC	SW-846, Method 0040	3~~7~~ sample sets plus one field blank
Method 0050[1]	HCl, Cl_2	SW-846, Method 0050	3~~7~~ sample sets plus one field blank
Method 0060	HRA Metals	SW-846, Method 0060	3~~7~~ sample sets plus one field blank
CEMS Method 25A	THC	40 CFR 60, Appendix A	Continuous each test run

1 - M0050 run in combination with one of the Method 5i trains (same train).

Table K-3-2. Sample Frequencies

SAMPLE	FREQUENCY
Scrubber Brine	Grab samples in last hr. of test runs 1,2, and 3. Three samples will be collected for Runs 1, 2 and 3. The first brine sample will be collected one hour after sampling begins. The second sample will be collected at port change and the third sample will be collected during the last hour of the run. VOA grabs for volatiles to be shipped directly to the laboratory for compositing prior to analysis.
Process Water	One sample per test burn.
NaOH Makeup	One sample per test burn.
TC Ash (MPF)	One composite sample per run if sufficient material is *available or one composite sample per trial burn.* Samples collected from individual TCs after exiting the furnace and cooling.
O_2/CO_2/CO	Continuous monitor & one average per run using EPA Method 3A and 10 (facility CEMS)
Method 0050, HCl, Cl_2	One two-hour train per run[1]
Method 5i, PM	Two two-hour trains per run[1]
Method 0031, Volatile Organics	4 Forty-minute tube sets per 6-hour run
Method 0010, Semivolatile Organics	One six-hour train per run
Method 0023A, PCDD/PCDF	One six-hour train per run
Method 0060, Trace Metals	One two-hour train per run
Guidance for Total Organics - Final Report (Method 0040 for Total Volatile Organics and Method 0010 for Total Semi and Nonvolatile Organics)	One six-hour M0040 train per run; One six-hour M0010 TOC train per run.

[1] - M0050 train is combined with one M5i train for joint determination of PM and HCl/Cl_2

1 **Table K-3-3. Sample Preservation and Holding Times**

MEASUREMENT (PARAMETER)	PRESERVATION	HOLDING TIME
PROCESS STREAMS (RESIDUE)		
Metals	Cool (4°C) pH < 2 Unpreserved	6 months (28 day Hg) 28 days (14 days Hg)
VOCs	Cool (4°C)	14 days
SVOCs	Cool (4°C)	Extract 14 days Analyze 40 days
PCDDs/PCDFs	Cool (4°C)	Extract 30 days Analyze 45 days
EXHAUST GAS		
Method 5i - PM	None Required	28 days
Method 0050 - Sulfuric Acid Solutions	No Additional Required	28 days
Method 0050 - Sodium Hydroxide Solutions	2 mL of 0.5 M $Na_2S_2O_3$	28 days
Method 0060	No Additional Required	28 days
VOST Tubes and Condensate	Cool (4°C)	14 days
VTOC - Bags	None	2 hours
VTOC - Condensate	Cool (4°C)	14 days
Method 0010	Cool (4°C)	Extract 14 days Analyze 40 days
Method 0023A	Cool (4°C)	Extract 30 days Analyze 45 days

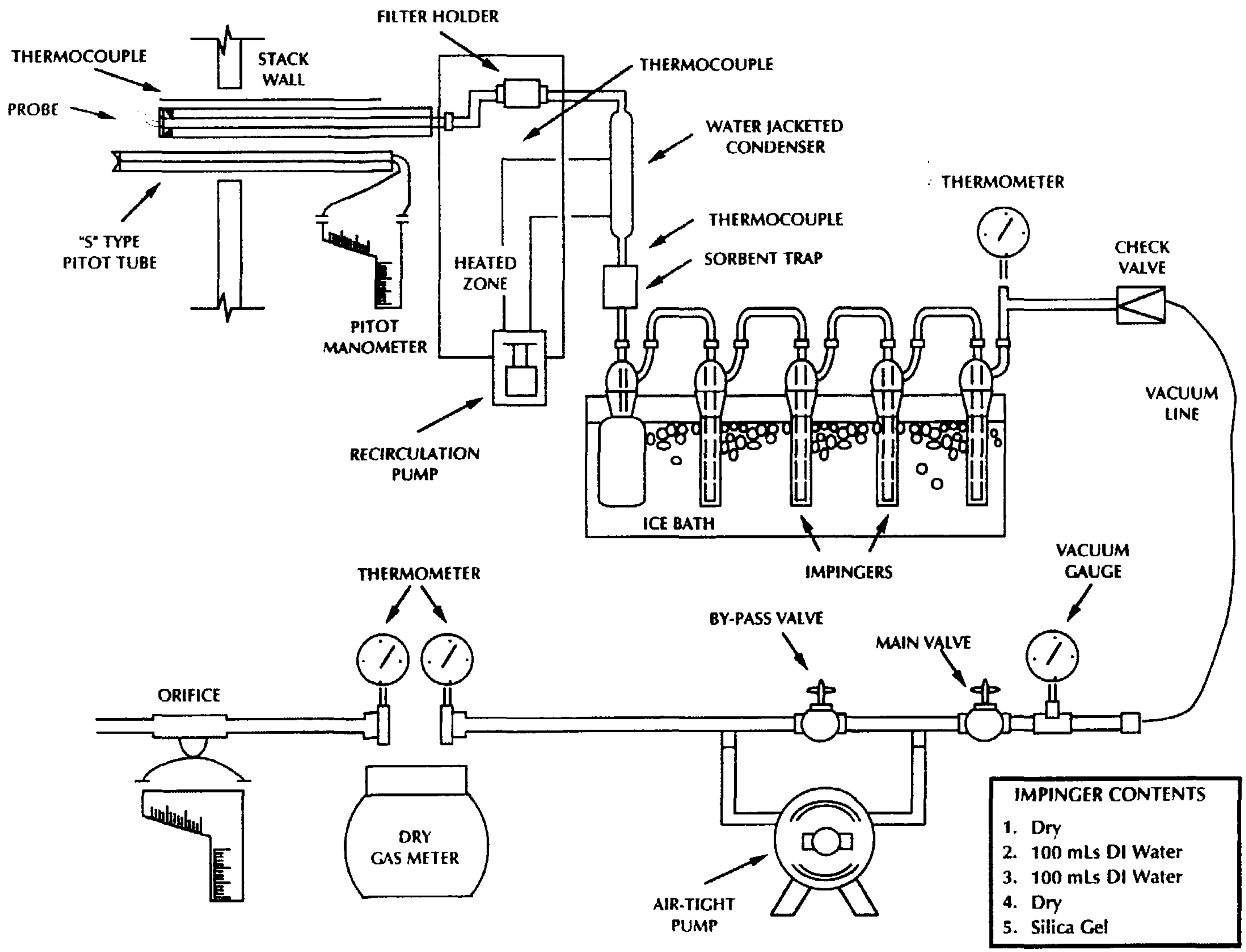


Figure 3-1. Method 0023A PCDD/PCDF Sampling Train

01280G

Figure K-3-1. M0023A

Figure K-3-2. M0060

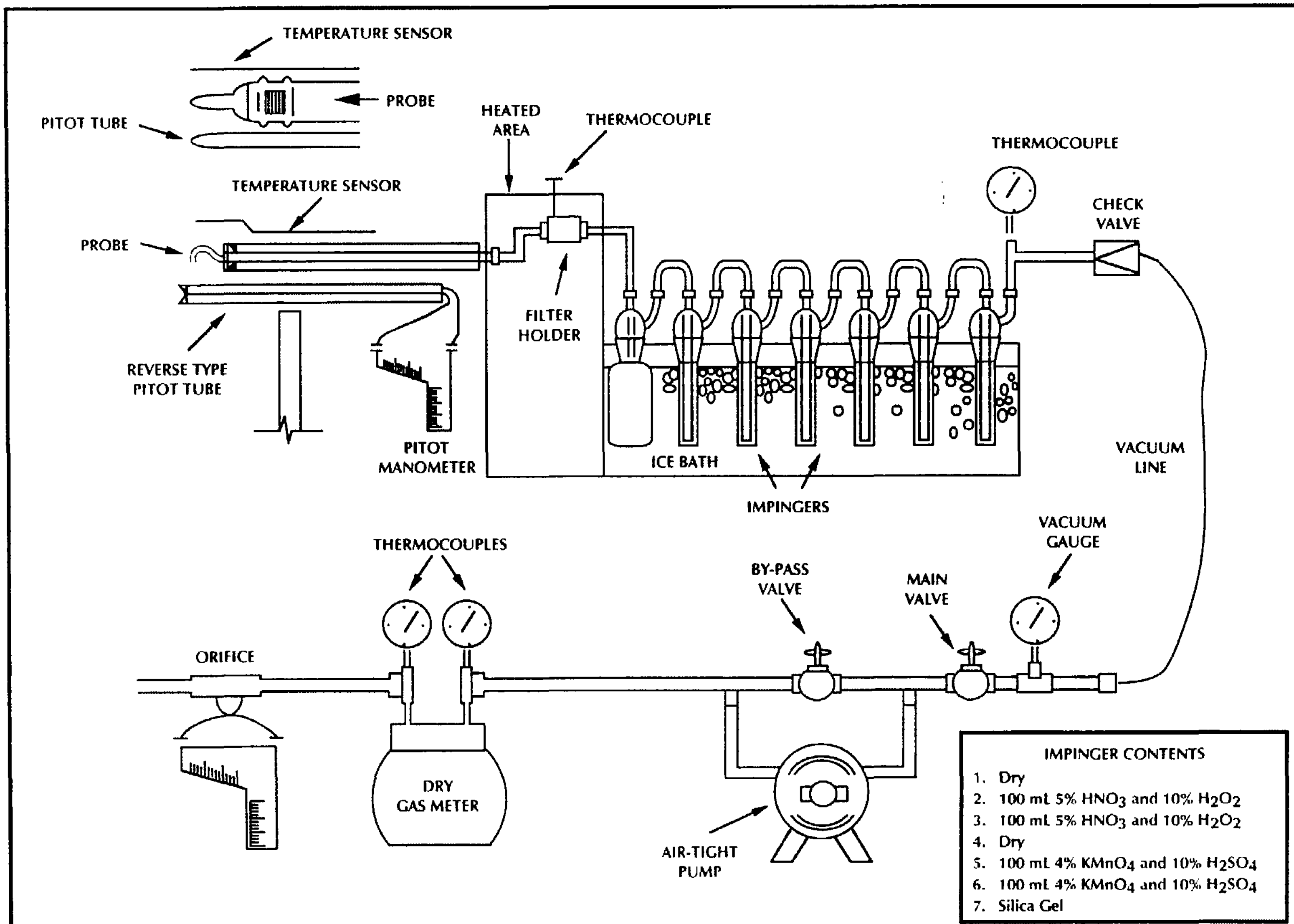


Figure 3-2. Method 0060 Trace Metals Sampling Train

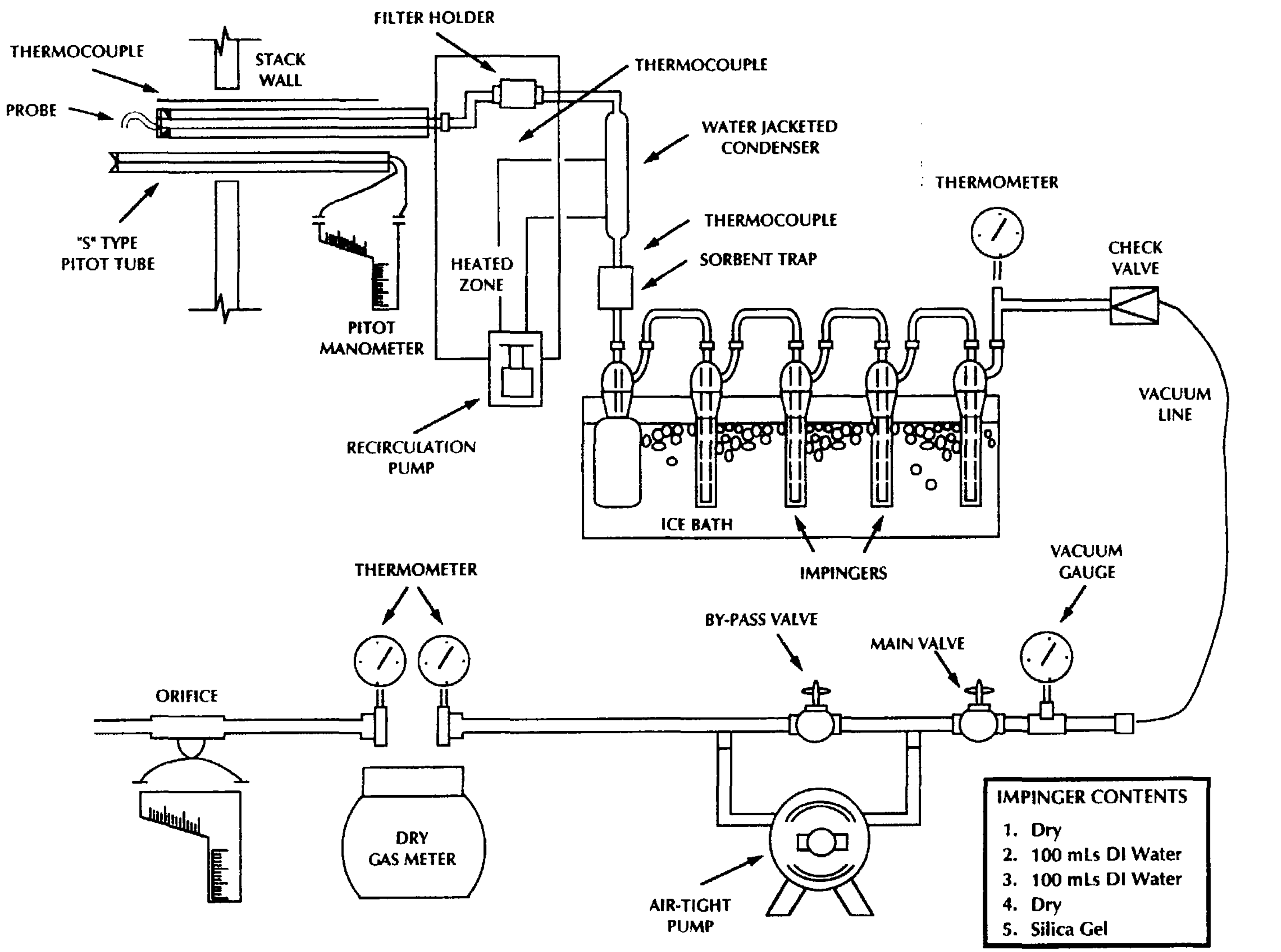


Figure 3-3. Method 0010 Semivolatile Organics Sampling Train

012809

Figure K-3-3. M0010

Figure K-3-4. M0031

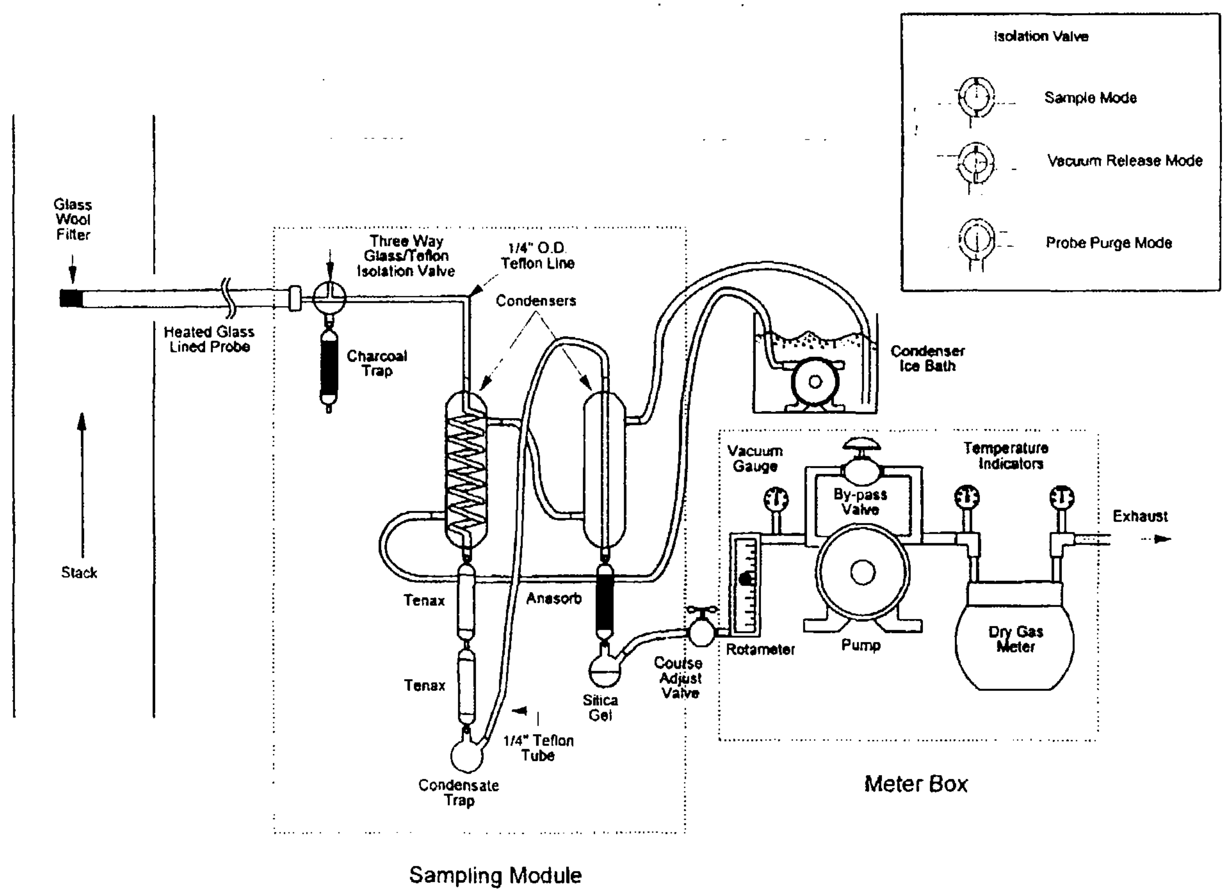


Figure 3-4. Method 0031 Volatile Organics Sampling Train (VOST)

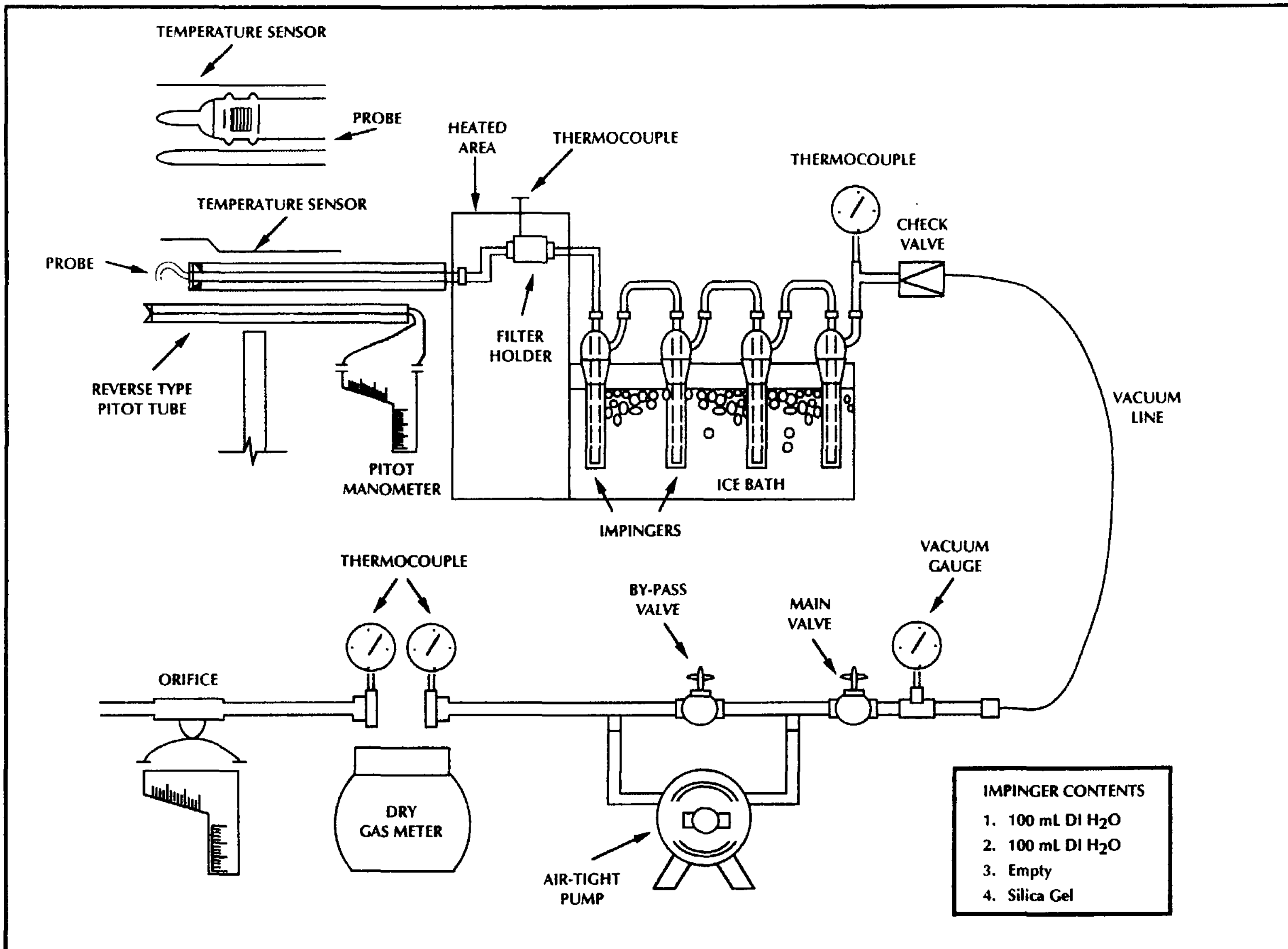
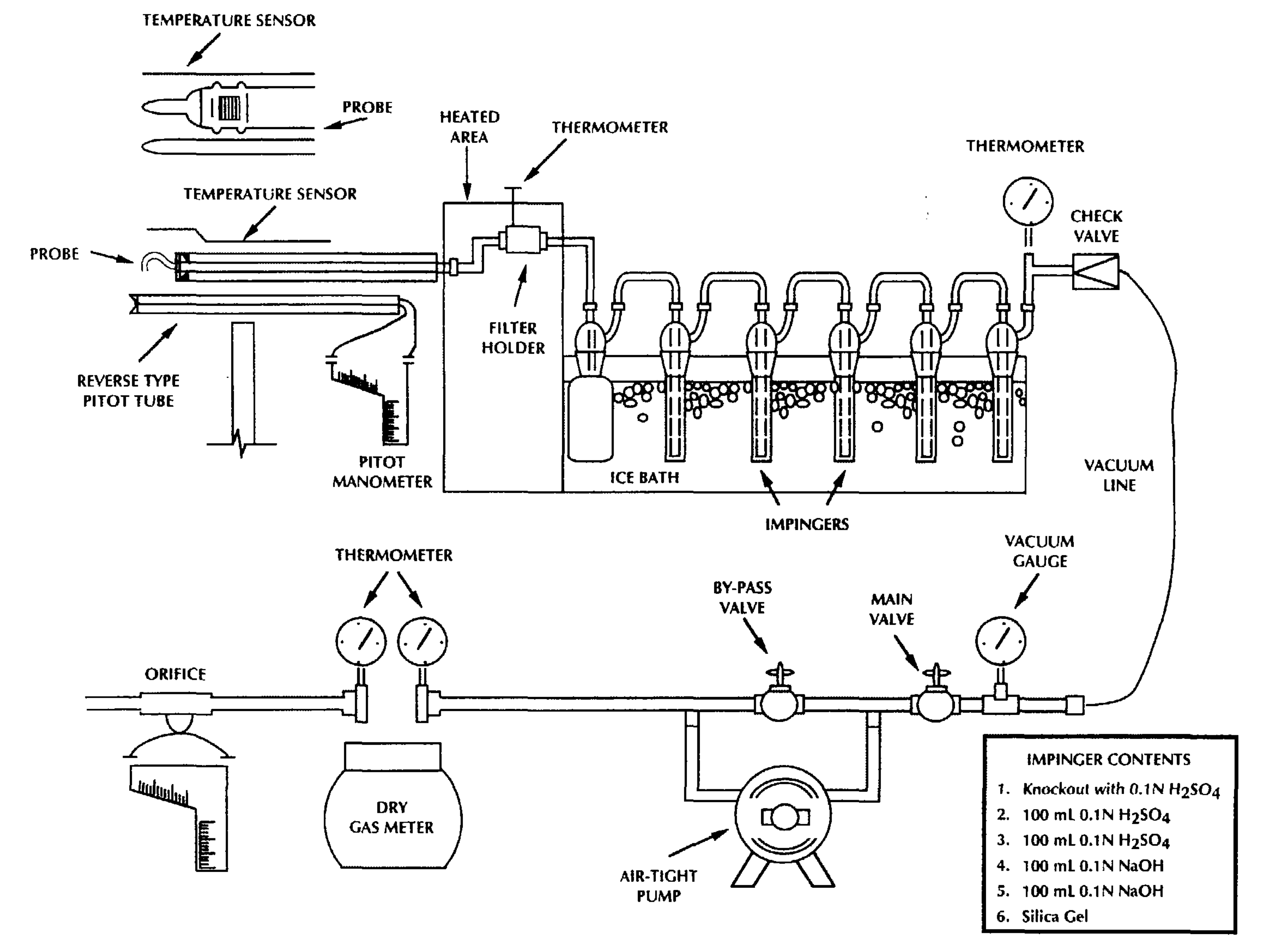


Figure 3-5. Method 5i Particulate Sampling Train

01280FOLDER 1/C

Figure K-3-5. M5i



01260.FOLDER D

Figure 3-6. Method 5i/0050 Particulate, HCl, Cl_2, and HF Sampling Train (Combined Train)

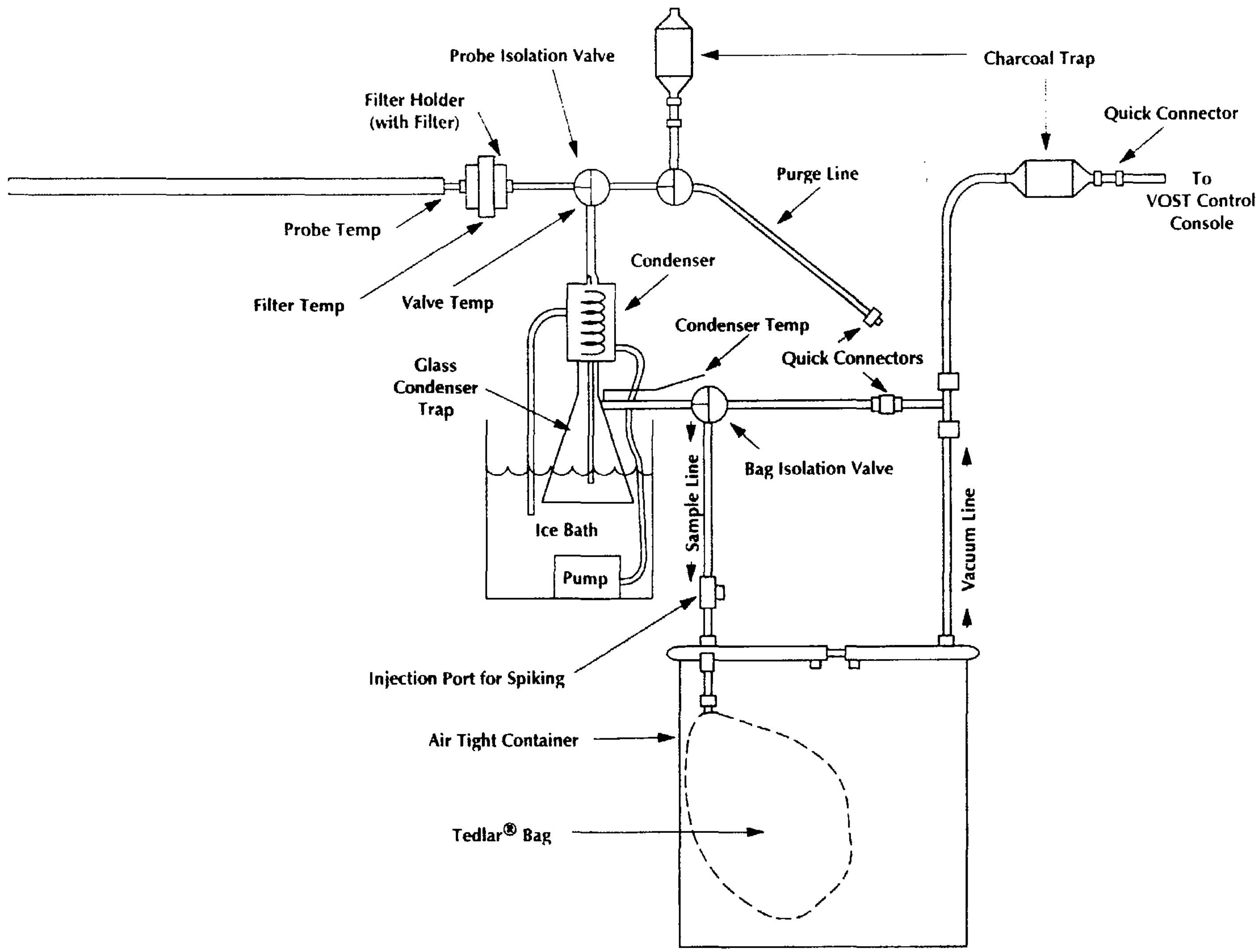


Figure 3-7. Method 0040 Total Volatile Organics Sampling Train

Figure K-3-7. M0040

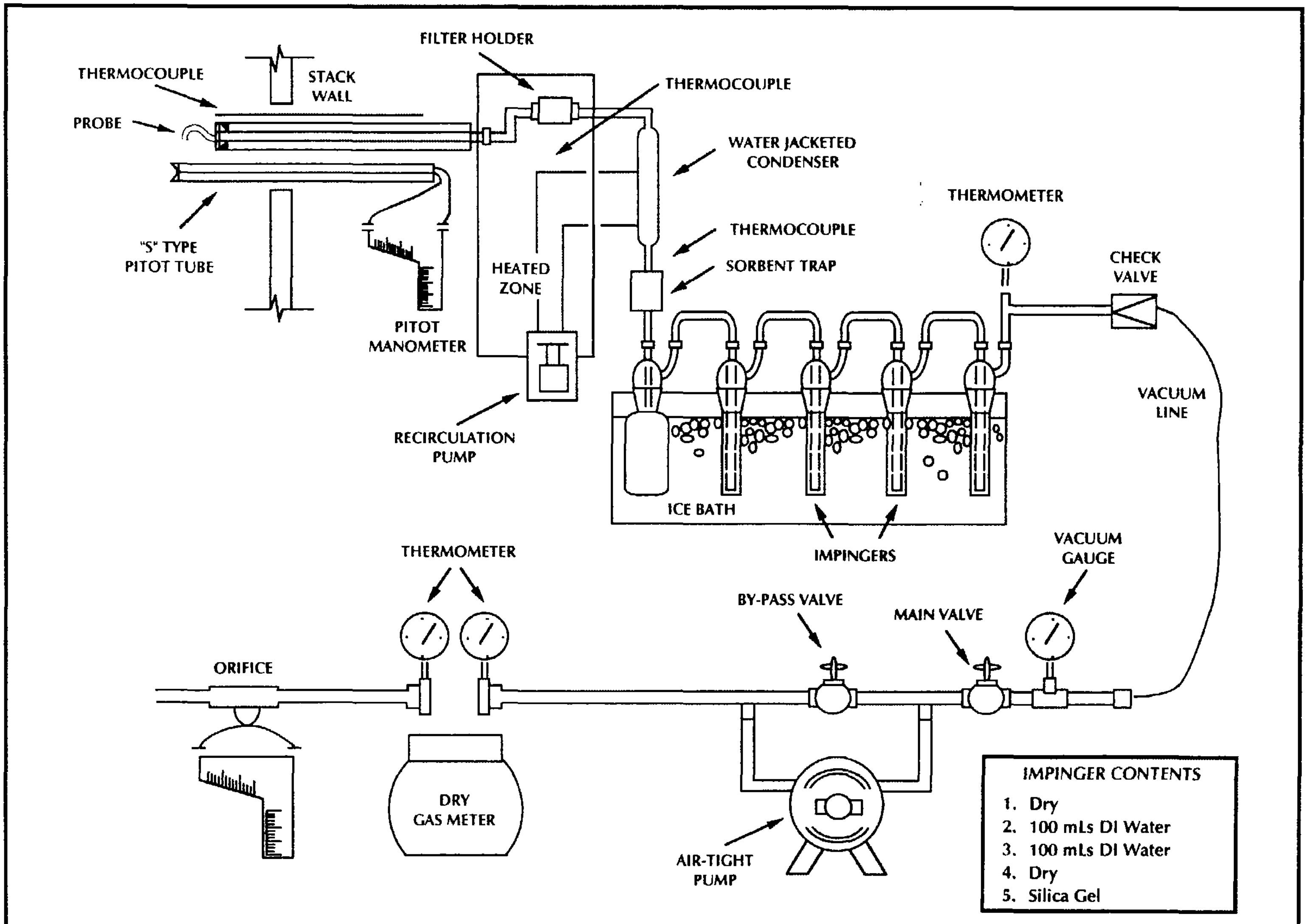


Figure 3-8. Method 0010 Total Semivolatile and Nonvolatile Organics Sampling Train

Section IV. Analytical Methods

This section delineates the analytical protocols which will be used to analyze samples during the Trial Burn. Tables K-4-1 and K-4-2 present summaries of the target analytes, matrices, and analytical methods.

1. Exhaust Gas Analytical Methods. Particulate Matter. The probe rinse and the filter assembly of the duplicate Method 5i trains will be used to determine the PM concentrations (note that one of the trains will be combined with M0050 reagents in the impingers). The probe rinse will be evaporated and desiccated. The filter housing including filter will be desiccated. The samples will be dried and desiccated. The samples will be analyzed gravimetrically for collection of particulate using the procedures in Method 5i.

2. Halides. The analysis of HCl and chlorine in the exhaust gas impinger samples will be performed by ion chromatography (IC) using SW-846, Method 9057. This method separates the anions by ion chromatography and the eluting anions are detected. The chlorine emissions are determined by the chloride analysis of the NaOH impinger contents using IC. Concentrations are calculated based on external calibration standards. Performance of the method will be evaluated using the criteria listed in the QA/QC tables found in Attachment B to the QAPP.

3. Volatile Organics.

a. The samples collected from each VOST set will consist of two Tenax™ tubes and an Anasorb™ backup tube. The VOST tubes will be analyzed for VOCs by thermal desorption and subsequent analysis by GC/MS, using SW-846, Method 5041A. The organic compounds in the sample will be thermally desorbed into water using a carrier gas. The desorbed compounds will then be purged from the water and collected on an analytical trap containing Tenax™ and other GC column packings. The compounds will be desorbed off the trap into the GC/MS.

b. The Tenax™ and Anasorb™ tubes will be analyzed separately to check against sample breakthrough. The two TenaxTM tubes will be combined for analysis while the Anasorb™ tube will be analyzed separately. Breakthrough will be defined as 30% or greater on the Anasorb™ tube relative to the Tenax™ tubes. This criterion will not apply if 75 nanograms (ng) or less are detected on the Anasorb™ tube. The results of the TenaxTM and Anasorb™ tubes will be summed for subsequent emission calculations.

c. Method 5041A will yield an analysis for VOCs that are usually identified as PICs. The method is calibrated with standards for the 49 target compounds listed in Table K-4-3. Concentrations of these 49 compounds will be reported for each VOST tube. The 20 largest additional peaks with an area at least 10% of the internal standards will be tentatively identified.

d. In the event high PIC concentrations are found in the initial back tube analyses, it may be necessary to incorporate the bag dilution step in the analysis. This step, developed by the laboratory, desorbs each tube into individual bags, removes a measured volume, and re-adsorbs the gas aliquot onto a clean tube. The tube is then desorbed and the analysis proceeds in accordance with M5041A. The final result is adjusted for the dilution factor and reported. QC spikes are introduced at each step of the dilution process to assess recoveries.

e. Performance of the method will be evaluated using the criteria listed in the QA/QC tables found in Attachment B to the QAPP.

4. PCDDs/PCDFs. The filter, XAD-2™ resin, and the impinger rinses will be extracted with toluene and evaporated to a known volume. The extract is then subjected to a series of cleanup procedures to remove interferences. The final extract will then be analyzed for PCDDs/PCDFs using Methods 0023A/8290. Table K-4-4 shows the target analyte list for this method. An aliquot of the cleaned extract is injected into a HRGC/HRMS. Quantitation is achieved by comparison to internal standards. Performance of the method will be evaluated using the criteria listed in the QA/QC tables found in Attachment B to the QAPP.

5. Semivolatile Organics. Semivolatile analyses will be conducted in accordance with SW-846 Methods 8270C. The filter/XAD-2™ resin, impinger contents, and rinses will be extracted with methylene chloride and evaporated to a known volume. The extracts are then analyzed by Method 8270C. An aliquot of the extract is injected into a HRGC. The column separates the compounds and the MS detects the compounds as they elute from the column. Method 8270C reports analyses for the 135 compounds listed in Table K-4-5. The compounds listed in Table K-4-5 are a tentative list of PICs pending identification of the most important PICs. The 20 largest additional peaks with an area at least 10% of the internal standards will be tentatively identified. Performance of the method will be evaluated using the criteria listed in the QA/QC tables found in Attachment B to the QAPP.

6. Total Organics.

a. Method 0040 will be modified to use a GC/FID as directed by the *Guidance for Total Organics*. The analysis of the VTOC samples involves two different methods. The bag samples are attached to the gas sampling valve of a GC. The gas is drawn into the gas sampling valve that holds a known gas volume. The sample is then injected into the GC where the column separates the compounds and the organic compounds are detected as they elute from the column. The response is then compared to standards. The second method is the analysis of the condensate sample by purge & trap/GC/FID. The water sample is placed in a purge device. The organic compounds are then stripped onto a trap. The trap is desorbed into a GC/FID.

b. The SVTOC and NVTOC fractions are analyzed by two different methods as directed by the *Guidance for Total Organics*. The Method 0010 sampling train is recovered by Method 3542. The sample fractions are prepared and combined into one extract sample. The extract is then divided into four portions. One portion of the extract is injected into a GC/FID. The column separates the compounds and they are detected with an FID as they elute from the column. The response is compared to external standards.

c. The NVTOCs are determined by taking two portions of the prepared extract and evaporating them to dryness at room temperature. This dried sample is weighed and the concentration calculated. Performance of these methods will be evaluated using the criteria listed in the QA/QC tables found in Attachment B to the QAPP.

7. Metals.

a. Elements to be analyzed in the samples recovered from the Method 0060 train are listed in Table K-4-6. The metals analyzed are those used in the HRA. The samples will be prepared as described in Method 0060. Analysis of the various fractions will be conducted using Methods 6020 and 7470A. Method 6020 is a promulgated method from SW-846 that uses inductively coupled plasma/mass spectroscopy (ICP/MS) for the analysis of metals. This method will be used for the analysis of 21 elements in the metal emission samples. This method was modified to include the analytes boron, phosphorus, and tin. The prepared samples are pumped into the nebulizer of the ICP which produces an atomic vapor. The atomic vapor enters the mass spectrometer which separates the elements based on their mass.

b. Method 7470A uses cold vapor atomic absorption spectroscopy for the analysis of mercury and is discussed in Section IV-3, page K-46. Performance of these methods will be evaluated using the criteria listed in the QA/QC tables found in Attachment B to QAPP.

8. Process Stream Analytical Methods.

a. During the MPF baseline test, scrubber brine, process water, caustic makeup, and ash residues will be sampled. There may be no TC ash generated during MPF baseline testing.

b. During the surrogate trial burn, scrubber brine, process water, caustic makeup, and TC ash will be sampled.

9. pH Analysis. The pH of the samples will be determined with a pH probe and pH meter using EPA Method 9045C. The pH probe and meter are calibrated using one or more standards. The pH probe is then placed in the solution to be analyzed. The pH reading is recorded. The pH probe is removed from the solution and rinsed with distilled or deionized water. The probe is then ready for the next measurement. The pH measurement is performed by OMC personnel.

10. Inorganic Analysis Methods.

a. The inorganic analyses on the process samples are limited to the analysis of the trace metals, TCLP metals and reactivity in the samples. The trace metals to be analyzed are:

Arsenic	(As)	Aluminum	(Al)
Antimony	(Sb)	Barium	(Ba)
Beryllium	(Be)	Boron	(B)
Cadmium	(Cd)	Chloride	(Cl^-)
Chromium	(Cr)	Cobalt	(Co)
Copper	(Cu)	Lead	(Pb)
Manganese	(Mn)	Mercury	(Hg)
Nickel	(Ni)	Phosphorous	(P)
Selenium	(Se)	Silver	(Ag)
Thallium	(Tl)	Tin	(Sn)
Vanadium	(V)	Zinc	(Zn)

b. All of these metals except mercury, arsenic, selenium, thallium, lead, and antimony are analyzed by ICP. Mercury is analyzed by a Method 7470A/7471A (CVAAS). Arsenic, selenium, thallium, lead and antimony are analyzed by ICP/MS.

c. The solid process streams will be subjected to a TCLP extraction according to SW-846 Method 1311 followed by trace metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) analysis according to SW-846 Methods 6010B and 7470A.

11. SW-846 Method 6010B - ICP - Atomic Emission Spectroscopy and SW-846 Method 6020, ICP/MS. The most recent version of the method will be used. A representative portion of the sample is digested with nitric acid using a hot plate. The sample digest is aspirated into the nebulizer of the ICP spectrometer and the emission of each analytical element determined. Analysis is performed by comparison of sample component responses to the responses of standards.

12. SW-846 Method 7470A (Liquids) and 7471A (Solids) - Mercury in Solid or Semi-Solid Waste (Manual Cold-Vapor Technique). A representative portion of the sample is digested with acids, potassium permanganate and potassium persulfate. Mercury ions are reduced to metallic mercury and the mercury vaporized. The mercury vapors are directed into the path of an atomic absorption spectrometer. Analysis is achieved by comparison of sample component responses to the responses of standards.

13. Organic Compound Analysis Methods. Scrubber recirculation brine, process water, NaOH makeup, and residue samples will be analyzed for volatile and semivolatile organic compounds using Methods 8260B and 8270C, respectively. These same samples will also be analyzed for dioxins and furans using EPA Method 8290. The most recent version of the test methods will be used.

14. SW-846 Method 8260BA - Volatile Organics by Gas Chromatography/Mass Spectrometry. A representative portion of the samples is introduced into a purge device. Solid samples with a concentration greater than 1 mg/Kg are extracted with methanol and the extract purged. Solid samples with concentrations below 1 mg/Kg are placed in a heated purge device and analyzed directly. The liquid is purged with an inert gas and the volatile compounds are collected on a sorbent trap. The trap is then heated and back flushed to desorb the compounds into the gas chromatograph (GC) and the separated compounds detected by mass spectrometry (MS). Analysis is performed by comparison of sample component responses to the responses of standards.

15. SW-846 Method 8270C - Semivolatile Organic Compounds by GC/MS. A representative portion of the sample is extracted using methylene chloride, then concentrated to a known volume. An aliquot of the extract is injected onto a GC column and the separate compounds detected by MS. Analysis is performed by comparison of sample compound responses to the responses of standards.

16. SW-846 Method 8290 - PCDDs and PCDFs by HRGC/HRMS. A representative portion of the sample is extracted with toluene and concentrated to a known volume. The extract is then subjected to a series of cleanup procedures to remove interferences. An aliquot of the cleaned extract is injected into a HRGC/HRMS. Analysis is performed by comparison to internal standards.

Table K-4-1. Exhaust Gas Sample Analysis Methods

PARAMETER	MATRIX	PREPARATION METHOD	ANALYSIS METHOD
VOCs	VOST Tubes/Condensate	5041A	5041A
SVOCs	XAD-2▯/ filter/ cond./rinses	3542	8270C
SVTOC and NVTOC	XAD-2▯/ filter/ cond./rinses	3542	GC/FID and Gravimetric
PCDDs/PCDFs	XAD-2▯/ filter/rinses	0023A	0023A/8290
VTOC	Bag/Condensate	0040/5030B	GC/FID
Particulate Matter (PM)	Filter/Rinse	Method 5i	Method 5i
HCl and Cl_2	Impinger Solution/Rinse	9057	9057
HRA Metals/Phosphorus	Filter/Impinger Solution/Rinse	0060	MM6020*/7470A

* Method 6020 was modified by adding the analytes boron, phosphorus, and tin.

Table K-4-2. Process Sample Analysis Methods

PARAMETER	MATRIX	PREPARATION METHOD	ANALYSIS METHOD
Reactivity	Brine/water/residues	SW-846 Chapter 7, Sec, 7.3	SW846 Chapter 7, Sec, 7.3
pH	Brine/water	9045C	9045C
HRA Metals	Brine/water	3010A/7470A	6010B/7470A
TCLP VOCs	Brine/water/residues	1311/5030B	8260B
TCLP SVOCs	Brine/water/residues	1311/3510C/3540C	8270C
TCLP Metals	Brine/water/residues	1311/3010A/7470A	6010B/7470A
PCDD/PCDF	MPF Residues	8290	8290

Table K-4-3. Target Analyte List for Analysis of Volatile Organic Compounds (VOCs) by Method 5041A

Acetone	1,2-Dichloropropane
Benzene	cis-1,3-Dichloropropene
Bromodichloromethane	trans-1,3-Dichloropropene
Bromoethene (Vinyl Bromide)[a]	Ethylbenzene
Bromoform	n-Hexane[a]
Bromomethane	2-Hexanone
2-Butanone	Iodomethane
1,3-Butadiene[a]	Methylene chloride
Carbon disulfide	4-Methyl-2-pentanone
Carbon tetrachloride	2-Propanol
Chlorobenzene	Styrene
Chlorodibromomethane	1,1,1,2-Tetrachloroethane
Chloroethane	1,1,2,2-Tetrachloroethane
Chloroform	Tetrachloroethene
Chloromethane	1,1,2-Trichloro-1,2,2-trifluoroethane[a]
2-Chloropropane[a]	Toluene
1,2-Dibromoethane	1,1,1-Trichloroethane
Dibromomethane	1,1,2-Trichloroethane
trans-1,4-Dichloro-2-butene	Trichloroethene
cis-1,1-Dichloro-2-butene	1,2,3-Trichloropropane
Dichlorodifluoromethane	Trichlorofluoromethane
1,1-Dichloroethane	Vinyl acetate[a]
1,2-Dichloroethane	Vinyl chloride
1,1-Dichloroethene	Xylenes (total)
trans-1,2-Dichloroethene	

[a] Response factor is obtained from a single analysis of the standard for this compound analyzed at a minimum of once per year. No method detection limit study or demonstration of capability are required.

Table K-4-4. Target Analyte List for Analysis of Dioxins and Furans (PCDDs/PCDFs) by Method 0023A/8290

2,3,7,8-Tetrachlorodibenzo-p-dioxin	2,3,7,8-Tetrachlorodibenzofuran
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1,2,3,7,8-Pentachlorodibenzofuran
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	2,3,4,7,8-Pentachlorodibenzofuran
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,4,7,8-Hexachlorodibenzofuran
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	1,2,3,6,7,8-Hexachlorodibenzofuran
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	2,3,4,6,7,8-Hexachlorodibenzofuran
Total Tetrachlorodibenzo-p-dioxin	1,2,3,7,8,9-Hexachlorodibenzofuran
Total Pentachlorodibenzo-p-dioxin	1,2,3,4,6,7,8-Heptachlorodibenzofuran
Total Hexachlorodibenzo-p-dioxin	1,2,3,4,7,8,9-Heptachlorodibenzofuran
Total Heptachlorodibenzo-p-dioxin	Total Tetrachlorodibenzofuran
Total Octachlorodibenzo-p-dioxin	Total Pentachlorodibenzofuran
	Total Hexachlorodibenzofuran
	Total Heptachlorodibenzofuran
	Total Octachlorodibenzofuran

Table K-4-5. Target Analyte List for Analysis of Semivolatile Organic Compounds (SVOCs) by Method 8270C

Acenaphthene	1,3-Dichlorobenzene	4-Methylphenol
Acenaphthylene	1,4-Dichlorobenzene	Pentachloroethane
Acetophenone	3,3'-Dichlorobenzidine	Naphthalene
2-Acetylaminofluorene	2,4-Dichlorophenol	1,4-Naphthoquinone
4-Aminobyphenyl	2,6-Dichlorophenol	1-Naphthylamine
3-Amino-9-ethylcarbozole[a]	Diethyl phthalate	2-Naphthylamine
Aniline	Dihydrosaffrole[a]	5-Nitroacenaphthene[a]
Anthracene	Dimethylaminoazobenzene	2-Nitroaniline
Aramite	7,12-Dimethylbenz(a)anthracene	3-Nitroaniline
Benzidine[a]	3,3'-Dimethylbenzidine	4-Nitroaniline
Benzoic acid[b]	∝,∝-Dimethylphenethylamine	Nitrobenzene
Benz(a)anthracene	2,4-Dimethyl phenol	2-Nitrophenol
Benzo(b)fluoroanthene	Dimethyl phthalate	4-Nitrophenol
Benzo(j)fluoroanthene[a]	1,3-Dinitrobenzene	5-Nitro-o-toluidine
Benzo(k)fluoroanthene	4,6-Dinitro-2-methylphenol	4 Nitroquinoline-1-oxide[b]
Benzo(g,h,i)perylene	2,4-Dinitrophenol[d]	N-Nitrosodibutylamine
Benzo(a)pyrene	2,4-Dinitrotoluene	N-Nitrosodiethylamine
Benzo(e)pyrene[a]	2,6-Dinitrotoluene	N-Nitrosodimethylamine
Benzyl alcohol	Dioxathion[a]	N-Nitrosomethylethylamine
Benzaldedhyde[a]	Diphenylamine	N-Nitrosodiphenylamine[d]
Benzenthiol[a]	1,2-Diphenylhydrazine[a]	N-Nitroso-di-n-propylamine
Biphenyl[c]	Di-n-octyl phthalate	N-Nitrosomorpholine[a]
Bis(2-chloroethoxy)methane	Ethyl methanesulfonate	N-Nitrosopiperidine
Bis(2-chloroethyl)ether	Ethyl parathion	N-Nitrosophyrrolidine
Bis(2-chloroisopropyl)ether	Fluoroanthene	Pentachlorobenzene
Bis(2-ethylhexy)phthalate	Fluorene	Pentachloronitrobenzene
4-Bromophenyl phenyl ether	Heptachlor[c]	Pentachlorophenol
Butyl benzyl phthalate	Hexachlorobenzene	Phenacetin
2-sec-Butyl-4,6-dinitrophenol	Hexachlorobutadiene	Phenanthrene
4-Chloroaniline	Hexachlorocyclopentadiene	Phenol
Chlorobenzilate	Hexachloroethane	1,4-Phenylenediamine[a]
4-Chloro-3-methylphenol	Hexachlorophene[c]	2-Picoline
1-Chloronaphthalene[a]	Hexachloropropene	Pronamide
2-Chloronaphthalene	Indeno(1 ,2,3-cd)pyrene	Pyrene
2-Chlorophenol	Isophorone	Pyridine
4-Chlorophenyl phenyl ether	Isosafrole	Quinoline[c]
Chrysene	Methapyrilene[a]	Safrole[a]
4-4'-DDE[a]	Methoxyclor[a]	1,2,4,5-Tetrachlorobenzene
Diallate (cis or trans)	Methycyclohexane[a]	2,3,4,6-Tetrachlorophenol
Dibenz(a,j)acridine[a]	3-Methylcholanthrene	o-Toluidine[a]
Dibenz(a,h)anthracene	Methyl methanesulfonate	p-Toluidine
Dibenzofuran	2-Methylnaphthalene	1,2,4-Trichlorobenzene
1,2-Dibromo-3-chloropropane[a]	2-Methyl-5-nitroaniline[a]	2,4,5-Trichlorophenol
Di-n-butyl phthalate	2-Methylphenol	2,4,6-Trichlorophenol
1,2-Dichlorobenzene	3-Methylphenol	1,3,5-Trinitrobenzene
n,n□-Diisopropylcarbodiimide[a]	Diisopropyl methylphosphonate[a]	Tributylamine[c]

[a] No method detection limit study or demonstration of capability required
[b] Response factor is derived from a 4-point calibration curve
[c] Response factor is based on historical data
[d] N-Nitrosodiphenylamine decomposes to diphenylamine. Laboratory quantifies as diphenylamine.

Table K-4-6. Target Analyte List for Analysis of HRA Metals by Method 0060

Aluminum (Al)	Lead (Pb)
Antimony (Sb)	Manganese (Mn)
Arsenic (As)	Mercury (Hg)
Barium (Ba)	Nickel (Ni)
Beryllium (Be)	Phosphorus (P)
Boron (B)	Selenium (Se)
Cadmium (Cd)	Silver (Ag)
Chromium (Cr)	Thallium (Tl)
Hexavalent Chromium (Cr+6)	Tin (Sn)
Cobalt (Co)	Vanadium (V)
Copper (Cu)	Zinc (Zn)

Section V. Quality Assurance/Quality Control

1. Introduction.

a. The Quality Assurance Program works to provide complete, precise, accurate and representative data in a timely manner for a project, considering both the project's needs and budget constraints. The Project QA Manager coordinates and directs the overall quality program with strong management support.

b. This section highlights the specific QA/QC procedures that will be followed for the surrogate trial burn and agent performance tests.

2. Field Quality Control Summary.

a. Calibration Procedures. Calibration of the field sampling equipment will be performed by the sampling contractor prior to the field sampling effort. Copies of the calibration sheets will be submitted to the field team leader to take onsite and for the project file. Calibrations will be performed as described in the EPA publications *Quality Assurance Handbook for Air Pollution Measurement systems; Volume III - Stationary Source Specific Methods*, (EPA-600/4-77-027b) and EPA 40 CFR Part 60, Appendix A. Equipment to be calibrated include the sample metering system, nozzles, barometers, thermocouples and pitot tubes. All calibrations will be available for review during the test program. Copies of the equipment calibration forms can be found in Attachment A.

b. Equipment Leak Checks. Prior to sampling, each sampling train will be leak checked according to the procedures outlined in EPA Reference Method 5. Initial and final leak checks will be performed to ensure that no leaks develop in the train during the course of the test run. In addition, leak checks will be conducted before and after every port change, or if the replacement of a component becomes necessary. All leakage rates will be recorded on the appropriate field data sheets located in Attachment B.

c. Cyclonic Flow Check. The presence or absence of cyclonic flow within the exhaust gas duct will be checked during preliminary traverses prior to sampling, in accordance with Section 2.4 of EPA Method 1.

d. Field Blanks. Blanks for all exhaust gas sampling methods will be taken during the field sampling program to ensure sample quality and integrity.

3. Sample Handling. This section will present the sample handling, sample traceability, chain-of-custody (COC) procedures, sample transport and field documentation that the sampling contractor will follow for the CAMDS MPF trial burn.

a. Sample Preservation. The sampling and packing technician will preserve the samples by keeping them under chilled or refrigerated conditions prior to transport. During transport the samples will be packed in insulated coolers and maintained at refrigerated temperatures by the use of ice or "blue ice." Attention will be given to the initiation of sample transportation as soon as sample clearance is obtained.

b. Sample Traceability. The purpose of sample traceability procedures is to document the identity of the sample and its' handling from its first existence as a sample until analysis and data reduction are completed. Custody records trace a sample from its collection through all transfers of custody until it is transferred to the analytical laboratory. Internal laboratory records then document the custody of the sample through its final disposition.

(1) Sample integrity will be maintained throughout all sampling and analysis programs. In accordance with SW-846, a sample is considered to be under a person's custody if the sample is:

- In that person's physical possession.
- In view of that person after acquiring possession.
- Secured by that person so that no one can tamper with the sample.
- Secured by that person in an area that is restricted to authorized personnel.

(2) These criteria will be used to define the meaning of "custody" and ensure the integrity of the test program samples from collection to data reporting. Restricted access to the samples is an integral part of the COC procedure.

(3) Samples will be held within sight of the samplers or sample custodian, and will be kept in sealed and secured containers at all times. Sealed containers will be used to ship samples to the laboratory.

4. Chain-of-Custody Documentation.

a. Labeling. Sample identification labels are used by the sampling contractor to ensure that the required information is entered in the field. Sample labels will be affixed to each appropriate container for process samples at the time of collection. Exhaust gas sample labels will be affixed to the appropriate container at the time of sample recovery. All samples collected during the trial burn will be labeled following a designated code system. Each sample label will be preprinted prior to the trial burn. Each label will contain the following information:

(1) Sample Identification Number

(2) Date of Collection (recorded at the time of collection/recovery)

(3) Initials of the Sample Collector (recorded at the time of collection/recovery)

(4) Matrix Type

(5) Analytical Method

(6) Type of Preservation Used, or "none" as applicable

(7) Run Number

(8) Identification of Trial Burn

b. Items such as impingers, XAD resin modules, gas sample bags (Orsat) and glass fiber filters will be labeled with tape to indicate the run number prior to sampling. If more than one train is being utilized in simultaneous testing, these train components will also be labeled to indicate the type of train and the labels will be keyed to specific trains. Since samples will be recovered for each of these components immediately after the test run in the field laboratory, no additional labeling will be necessary.

c. Integrity Seals. Integrity seals will be placed over the top of the sample containers to detect unauthorized sample handling. These seals will be attached so that they must be broken to open either the individual sample containers or shipping containers. Gummed labels or equivalent are acceptable for this purpose. The seal will include the following information: date and the initials of the person recovering the sample.

d. Field Logbook. A permanently bound field logbook will be maintained by the sampling contractor's Field Team Leader. Information pertinent to the sampling will be recorded in a sampling log. All entries will be made in indelible ink and all corrections will follow error correction protocol of one line through the error, initial of person performing the correction. The following information will be included:

<u>General Entries</u>:	<u>Specific Entries Per Test Run</u>:
Test Burn Sampling	Date of Run
Installation	Start/Stop Times of each Type of Sampling Train
Facility	Process Upsets
Project Number	Delay Times
Project Manager	

e. Chain-of-Custody Forms. To establish the documentation necessary to trace sample possession from the time of collection, a COC form must be filled out (in four parts) and must accompany every sample or group of individually identified samples. Each person who has custody must sign the COC form, which will contain the following information:

(1) Sample identification number

(2) Date of sample collection

(3) Signature or initials of sample collector (must be legible)

(4) Matrix type

(5) Container type

(6) Size of container

(7) Signature of persons with custody

(8) Date and time of each custody change

5. Sample Shipping.

a. Samples will be packaged and shipped according to U.S. Department of Transportation, International Air Transportation Authority, and EPA regulations.

b. Samples will be delivered to the laboratory so that the requested analyses can be performed within the specified allowable holding time.

c. Samples will be accompanied by the COC form. The COC form will list the variables to be analyzed by the laboratory and the total number and type of samples shipped for analysis.

d. Authorized laboratory personnel will acknowledge receipt of shipment by signing and dating the COC form and returning a copy to the onsite Field Team Leader. The laboratory manager will also sign and date the paperwork accompanying the samples and keep it on file with the sample information.

Section VI. Final Report

1. Contents. The sampling contractor will submit a complete Draft and Final MPF STB Test Report providing operating details and outlining the goals, methods and results for the MPF STB program. Any deviations from the SSOP and QAPP will be documented. The Final Report will undergo technical review by CAMDS personnel prior to release to the Chemical Materials Agency (CMA). Included in the Final Report will be the following sections:

a. Executive Summary - A concise overview of the program with a tabular summary of pertinent emission parameters.

b. Introduction - A discussion of the project background and objectives, and a description of the facility.

c. Summary and Discussion of Results - A presentation of all pertinent program results for the trial burn testing, including operations data, sampling train results, summaries, and DRE calculations (Data will be reagent blank-corrected, as appropriate to the method, and reported. VOST data will be blank-corrected according to the "Handbook on Quality Assurance/Quality Control Procedures for Hazardous Waste Incineration," (EPA-625-66-89-023), January 1990. All data will be reported both blank-corrected and uncorrected, if blank correction is performed).

d. Process Description - A presentation of all sampling locations and process information, as well as summaries of the daily test activities.

e. Sampling Methods - A detailed presentation of the various methods used in the program for sampling exhaust gases and process streams.

f. Analytical Methods - Procedures used in analyzing the exhaust gas and process stream samples for the target analytes.

g. Quality Assurance/Quality Control - A summary of the pertinent QA/QC results relating to the analysis of the program's samples, blanks, and surrogate and matrix spike recoveries. Additionally, a summary of the sampling train leak checks will be presented.

h. Appendices - A presentation of all remaining program-related items including all field sampling and recovery data sheets, laboratory analytical reports, sample tracking forms, calibration data, process and feed rate, PDAR and trended data.

i. Within each section of the trial burn report, the sampling contractor will present descriptions and results summaries in detail. Data averages will be included in the tables and any outliers noted. The POHC DRE presentation and discussion is of crucial importance to each trial burn report and supporting calculations for DRE determination will be presented. The sampling contractor will also discuss the general DAS process data package if provided by CAMDS and obtain the list of process tags or signal outputs that will be generated and recorded during operations.

j. In compiling and presenting the data from the LIC STB, the sampling contractor will only make objective, validated statements regarding system performance and results.

2. Report Appendices.

a. A full set of appendices will be prepared and submitted with the LIC STB report. Certain information for inclusion in the appendices will be provided by the Government. The sampling contractor will relay these requirements. The contents of each set will include, at a minimum:

(1) Field Data Sheets

(2) Reduced Field Data

(3) Laboratory Analytical Reports

(4) Process Feed Data

(5) PDARS Printouts/Process Trends

(6) Sample Chain-of-Custody Forms

(7) Equipment Calibrations

(a) Sampling Equipment

(b) Process Equipment

(c) CEMS Equipment

(8) Reagent List/Lot Numbers

(9) Media Preparation Records

b. The trial burn report will be prepared in accordance with established EPA guidelines and the approved trial burn plan.

3. Analytical Data Package. A full verifiable analytical data package will be assembled and submitted with the trial burn report. The sampling contractor will submit a full data package with the draft trial burn report to allow the reviewers access to detailed analytical data. The data package will be submitted as an appendix to the final trial burn report.

Attachment A
Equipment
Calibration Forms

NOZZLE CALIBRATION

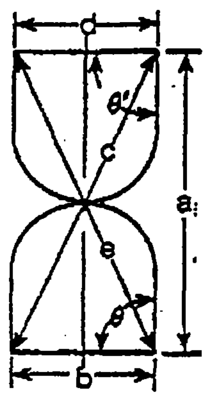
Nozzle No.	Diameter (inch)				Nozzle Set No.
	a	b	c	Averag	

S-TYPE PITOT GEOMETRIC CALIBRATION
PART 2 - PITOT ALIGNMENT

Procedure No. T/S-811
Revision No. 1
Date December 9, 1980
Page ______ of ______

TRC Probe Identification ______ Technical Specialist ______
Pitot Identification ______ Date ______

A. Transverse Tube Axis



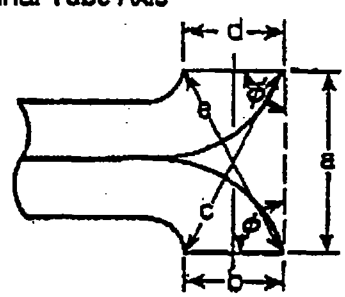
a ______
b ______
c ______
d ______
e ______

$\frac{a^2+b^2-c^2}{2ab} = \cos\theta$

$\frac{a^2+d^2-e^2}{2ad} = \cos\theta'$

θ ______ (80° < θ < 100°)
θ' ______ (80° < θ' < 100°)

B. Longitudinal Tube Axis



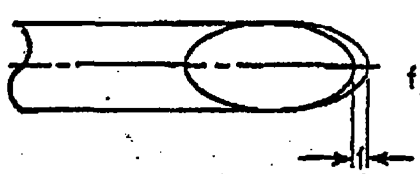
a ______
b ______
c ______
d ______
e ______

$\frac{a^2+b^2-c^2}{2ab} = \cos\phi$

$\frac{a^2+d^2-e^2}{2ad} = \cos\phi'$

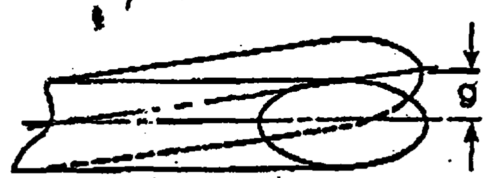
φ ______ (85° < φ < 95°)
φ' ______ (85° < φ' < 95°)

C. (f < 1/8")



f 0

D. (g < 1/32")



g 0

NOTE: Values in parentheses are EPA Method 2 specifications.

PROBE THERMOCOUPLE CALIBRATION

TOLERANCES
°R = °F + 460

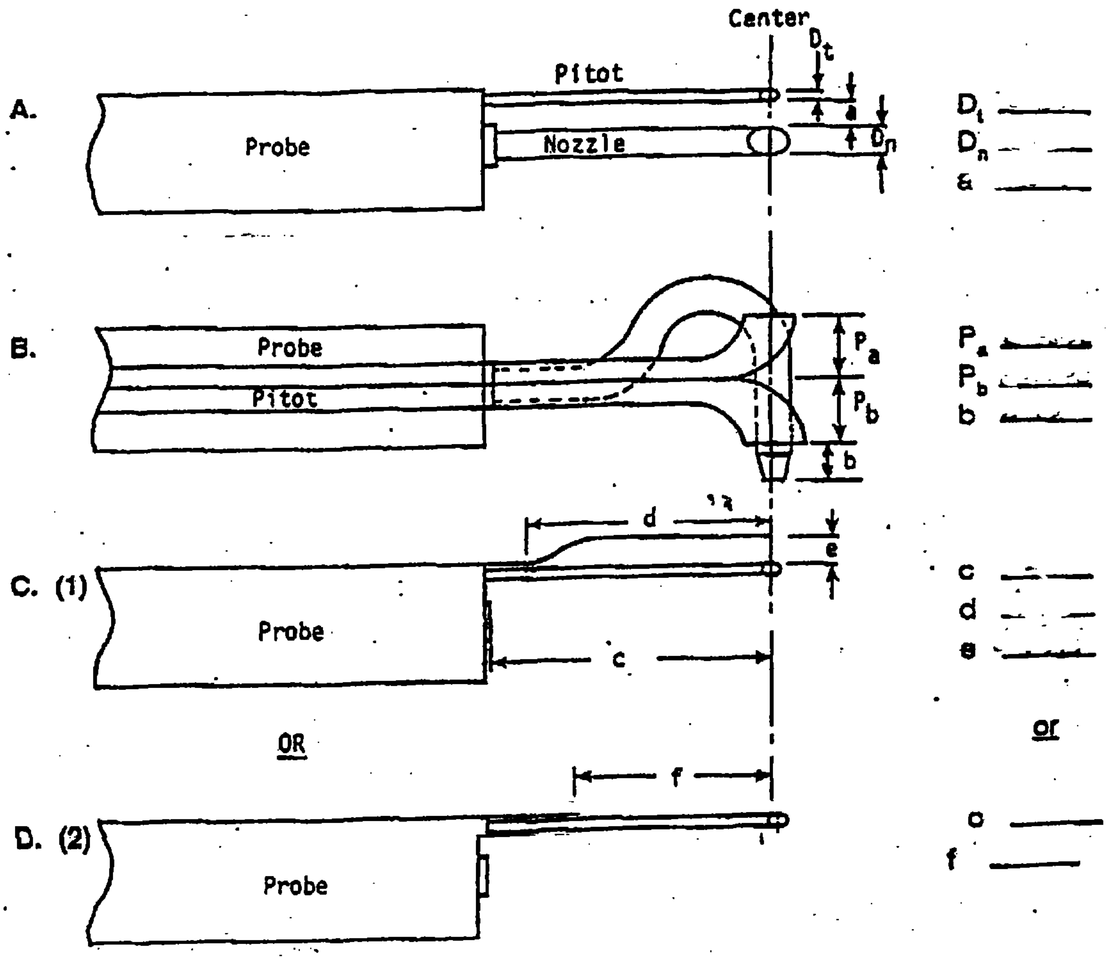
Thermocouple Identification ______
Expected Stack Temperature (T_s) ______ °R
Reference Thermometer (T_{ref}) Ref Thermocouple °R (T_s ± 10%)
Thermocouple Readout Cal sheet attached °R (T_{ref} ± 1.5%)

Technician ______ Date ______
Reviewed By ______ Date ______

S-TYPE PITOT GEOMETRIC CALIBRATION
PART 1 - PROBE CONFIGURATION

Procedure No. T/S-811
Revision No. 1
Date December 9, 1980
Page 2 of 2

TRC Probe Identification ______ Technical Specialist ______
Pitot Identification ______ Date ______



SPECIFICATIONS (EPA METHOD 2)

D_t = 3/16" to 3/8"	$c \geq 3"$	$P_a = P_b$
D_n = 1/2"	$d \geq 3"$	
$a \geq 3/4"$	$e \geq 3/4"$	$1.05\ D_t \leq P \leq 1.50\ D_t$
$b \geq 0$	$f \geq 2"$	

If these specifications are met, proceed with Part 2 Pitot alignment.

METERBOX THERMOCOUPLE CALIBRATION FORM

METERBOX NUMBER:

Thermocouple Number	Reference Temp. I °F	Temp. Reading 1 °F	Criteria	Reference Temp.2 °F	Temp. Reading 2 °F	Criteria
#1						
#2						
#3						
#4						
#5						

Thermocouple Number	Reference Temp. 3 °F	Temp. Reading 3 °F	Criteria	Reference Temp.4 °F	Temp. Reading 4 °F	Criteria
#1						
#2						
#3						
#4						
#5						

Name: ______________________________

Date: ______________________________

Criteria; Percent difference between the Reference Temperature

Equation: ((Ref. Temp. + 460) - (Temp. Reading + 460)) x 100 (Ref. Temp. + 460)

METERBOX CALIBRATION WORKSHEET

Time Minutes	Inlet Temperature	Outlet Temperature
0		
2		
4		
6		
8		
10		
12		
14		
15		
Average		

Meterbox Serial No.	Date
WTM Serial No.	Barometric Pressure (PB)
Δ H	Calibrated By
0.5 1.0 1.5 2.0 3.0	
Final DGM	Final WTM
Initial DGM	Initial WTM
Net DGM	Net WTM
Vac. In. Hg.	Avg. DGM Temp.
Wet Test Meter Temperature °F	
Total Time, minutes, seconds 15.0	

METHOD 5 DRY GAS METER CALIBRATION

Calibrated: ____________________ Barometric Pressure, 30.12 in. Hg

Date: ____________________ Meter Box No.: ____________________

Orifice Manometer Setting delta H in. H_2O	Gas Volume Wet Test Meter Vw ft^3	Gas Volume Dry Test Meter Vd ft^3	Temperature: Wet Test Meter tw °F	Temperature: Dry gas meter: Inlet td_i °F	Temperature: Dry gas meter: Outlet td_o °F	Temperature: Dry gas meter: Average td_a °F	Time T min.	Y	delta H @	Deviation: Y	Deviation: delta H @
0.5	0.000	0.000	0.0	0	0	0	15.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.0	0.000	0.000	0.0	0	0	0	15.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.5	0.000	0.000	0.0	0	0	0	15.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2.0	0.000	0.000	0.0	0	0	0	15.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
3.0	0.000	0.000	0.0	0	0	0	15.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
							AVERAGE	#DIV/0!	#DIV/0!		

CALCULATIONS

Y	delta H @
$\dfrac{Vw \times Pb \times (td_a + 460)}{Vd \times (Pb + dH/13.6) \times (tw + 460)}$	$\dfrac{0.0319 \times dH}{Pb \times (td_a + 460)} \times \left[\dfrac{(tw + 460) \times T}{Vw}\right]^2$

Y = Ratio of reading of wet test meter to dry gas meter;
Tolerance for individual value ± 0.02 from average

delta H @ = Orifice pressure differential that equates to 0.75 cfm of air at 68°F and 29.92 inches of mercury, in. H2O;
Tolerance for individual values ± 0.20 from average

Attachment B
Field Data Forms

FIELD PROGRAM LOG

Project No.: ______________________

Client: ______________________

Plant: ______________________

Team Leader: ______________________

Date	Time	Description of Events

TRAVERSE POINT LOCATION FOR CIRCULAR AND RECTANGULAR DUCTS

ject No.:______________________________

ient:________________________________

Date:________________________________

Sampling Location:________________________

Internal Stack Diameter:_____________________

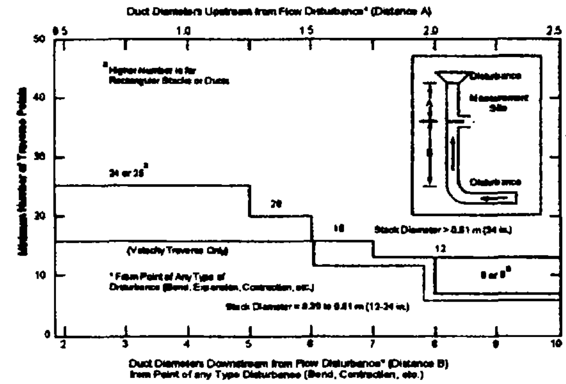
Nipple Length:____________________________

Total Stack Diameter:________________________

Nearest Upstream Disturbance (A):______________

Nearest Downstream Disturbance (B):____________

Calculator:______________________________



Rectangular Duct Equivalent Diameter Determination = $\frac{2 \times L \times W}{L + W}$

	1	2	3	4	5
Travers e Point Number	Fraction of Stack ID (1 / 100)	Stack ID	Traverse Point (1 x 2 = Point)	Nipple Length	Traverse Point Inside of Far Wall to Outside of Port Nipple (3 + 4 = Point)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

Location of Traverse Points in Circular Stacks
[Percent of stack diameter from inside wall to traverse point]

	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	5..7	4.4	3.2	2.6	2.1	1.3	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.3	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Location of Traverse Points in Rectangular Stacks

	Number of traverse points on a diameter										
	2	3	4	5	6	7	8	9	10	11	24
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	15.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	85.4	79.2
11										95.5	87.5
12											95.8

Date:	Project No.:
Client:	Sample Location:
Facility:	Load Condition:
Run No.:	Operator:
Barometric Pressure (in. Hg):	Meterbox No.:
% Moisture:	Static (in. H_2O):
Pitot Tube ID:	Pitot Tube Coefficient:
Post Leak Check:	Stack Diameter (in.):
Measurement Device:	Schematic of Stack Cross Section:
Micromanometer:	
10" Manometer:	
Magnehelic:	
Other:	
Explain:	
	Stack Diameters Upstream:
	Stack Diameters Downstream:

Time (24 hr. clock)	Sample Point	Stack Temp °F or °C	Manom. Reading in H_2O	Cyclonic Flow Null Angle

Time (24 hr. clock)	Sample Point	Stack Temp °F or °C	Manom. Reading in H_2O	Cyclonic Flow Null Angle

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Field Moisture Determination

Client: ____________________ Project No.: ____________________
Location: ____________________ Date: ____________________
Run No.: ____________________ Operator: ____________________

Data

Minutes	Clock Time	Gas Meter cf vm	TM In	TM Out	Orifice In. H_2O (+)	Vac. Gage In. Hg (-)
0						
5						
10						
15						
20						
25						
30						
Total/ Avg						

Impingers

	1	2	3
Final mL			
Initial mL			
Net mL			

Total Moisture (Net mL + Net gm) = ____________________

Silica Gel

Container No. ____________________
Final gm ____________________
Intial gm ____________________
Net gm ____________________

Calculations

(1) PB = ____________________ Meterbox No.: ____________________
(2) VM Net = ____________________ Y = DGM Calibration Factor = ____________________
(3) TM Avg = ____________________ TM + 460 = ____________________

(4) PM Avg = + ____________________ Orifice in. H_2O $\times \frac{1}{13.6}$ = + ______ orifice in.Hg.
= - ____________________ Vacuum gage In. Hg (when meter is before pump)

(5) $VMSTD = \dfrac{528 \times VM \times (PB + PM) \times (Y)}{29.92 \times (TM + 460)}$ = ____________________

(6) VW = mL H_2O + gm Silica Gel = ____________________

(7) VW Gas = VW × 0.04715 = ____________________

(8) $\%M = \dfrac{100 \times VW\ Gas}{VMSTD + VW\ Gas} = \dfrac{100 \times (\qquad)(\qquad)}{(\qquad) + (\qquad)} = (\qquad) =$

Project No.: ____________________ Date: ____________________

Client: ____________________ Source: ____________________

Plant: ____________________ Sample Location: ____________________

Calculated by: ____________________ Checked by: ____________________

T_S = ______ °F + 460 = [ ] °R ΔP_{AV} = [ ]

T_M = ______ °F + 460 = [ ] °R C_p = [ ]

MWD = [ ] # / # - mole

MWS = [ ] # / # - mole

MD = [ ]

PB (PM) = [ ]

PST = $\frac{\quad}{13.6}$ = [ ]

PS (PB ± PST) = [ ]

Sampling Rate, dscfm, Q_m

(1) @ $\Delta H@$ = 0.75 (normal)

(2) At any other ΔH:

$$\left(\frac{\Delta H}{\Delta H_{@}}\right)^{1/2} \times 0.75 = \left(\frac{\quad}{\quad}\right)^{1/2} 0.75 = \frac{\quad}{\text{dscfm}}$$

$$D_{N \text{(desired)}} = \left[\left(\frac{(TS)\ (MWS)}{(PS)\ (\Delta P_{AV})}\right)^{1/2} \left(\frac{0.0357\ (Q_M)\ (PM)}{(TM)\ (C_p)\ (MD)}\right)\right]^{1/2}$$

$$= \left[\left(\frac{(\quad)(\quad)}{(\quad)(\quad)}\right)^{1/2} \left(\frac{0.0357\ (\quad)(\quad)}{(\quad)(\quad)(\quad)}\right)\right]^{1/2}$$

D_N = [ ] inches D_N Actual = [ ] inches

K-Factor Calculation Sheet

Project No.: ______________________ Date: ______________________

Client: ______________________ Source: ______________________

Plant: ______________________ Sample Location: ______________________

Calculated by: ______________________ Checked by: ______________________

TM & TS in °R

$$K = \frac{\Delta H}{\Delta P} = 846.72\ (DN)^4\ \Delta H_@\ CP^2\ (Md)^2 \left(\frac{MWD}{MWS}\right)\left(\frac{TM}{TS}\right)\left(\frac{PS}{PM}\right)\ ;\ \Delta H = K\Delta P$$

T_s = [ ] °F + 460 = ________ °R

$K = \frac{\Delta H}{\Delta P} = 846.72\ (\quad)^4\ (\quad)\ (\quad)^2\ (\quad)^2 \left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)$

K = [ ] $\Delta\bar{P}$ = ________, $\Delta\bar{H}$ = ________, ΔP_{MAX} = ________, ΔH_{MAX} = ________,

---

T_s = [ ] °F + 460 = ________ °R

$K = \frac{\Delta H}{\Delta P} = 846.72\ (\quad)^4\ (\quad)\ (\quad)^2\ (\quad)^2 \left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)$

K = [ ] $\Delta\bar{P}$ = ________, $\Delta\bar{H}$ = ________, ΔP_{MAX} = ________, ΔH_{MAX} = ________,

---

T_s = [ ] °F + 460 = ________ °R

$K = \frac{\Delta H}{\Delta P} = 846.72\ (\quad)^4\ (\quad)\ (\quad)^2\ (\quad)^2 \left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)$

K = [ ] $\Delta\bar{P}$ = ________, $\Delta\bar{H}$ = ________, ΔP_{MAX} = ________, ΔH_{MAX} = ________,

---

T_s = [ ] °F + 460 = ________ °R

$K = \frac{\Delta H}{\Delta P} = 846.72\ (\quad)^4\ (\quad)\ (\quad)^2\ (\quad)^2 \left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)$

K = [ ] $\Delta\bar{P}$ = ________, $\Delta\bar{H}$ = ________, ΔP_{MAX} = ________, ΔH_{MAX} = ________,

---

T_s = [ ] °F + 460 = ________ °R

$K = \frac{\Delta H}{\Delta P} = 846.72\ (\quad)^4\ (\quad)\ (\quad)^2\ (\quad)^2 \left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)\left(\frac{\quad}{\quad}\right)$

K = [ ] $\Delta\bar{P}$ = ________, $\Delta\bar{H}$ = ________, ΔP_{MAX} = ________, ΔH_{MAX} = ________,

---

AF-248A

VOST Data Sheet

Project No.:	Date:
Client:	Flow Rate (Lpm):
Facility:	DGM Y at Lpm:
Source:	Barometric Pressure:
Sample Location:	Operator:
DGM No.:	Sample Point Location:
Run No.:	Port: Point:

Train Leak Check Initial: VAC: ____________in/Hg. ____________Δ in/Hg. ____________ sec

Train Leak Check Final: VAC: ____________in/Hg. ____________Δ in/Hg. ____________ sec

Clock Time (24 hr)	Sampling Time (min)	Rotameter Reading L/min.	Gas Sample Volume liters	1st Cond. Outlet Temp. °C	Gas Sample Temp.		Probe Temp. °F	Pump Vacuum in.Hg Gauge
					At Dry Inlet °C	Gas Meter Outlet °C		

Sample Trap I.D.

Field Blank Tenax: ______________________

Field Blank Tenax/Charcoal: ______________________

Sample Tenax: ______________________

Sample Tenax/Charcoal: ______________________

Comments:

____

____

____

____

ISOKINETIC FLUE GAS SAM)G DATA SHEET

Project No.:	
Client:	
Facility:	
Source:	
Sample Location:	
Stack Diameter:	
Date:	
Run No.:	
Operator:	
Meterbox No.:	
Meterbox ΔH @:	
Y Factor:	

VERY IMPORTANT - FILL IN ALL BLANKS
Read and Record at the Start of Each Test Point
SKETCH

Sheet ________ of ________

Train Prepared By:	
Pitot Number and Side:	
Pitot Tube CP:	
Filter No.:	
Ambient Temp., °F:	
Bar. Pressure, In. Hg.:	
Assumed Moisture, %:	
Heater Box Setting, °F:	
Nozzle # / Dia., In.:	
Probe Length / Material:	
Probe Heater Setting:	

	Clock Time				Orifice ΔH Inches H_2O		Dry Gas Temperature, °F				Temperatures °F °C					
Point	24-hr	min	Dry Gas Meter, (ft^3)	Pitot In. H_2O ΔP	Desired	Actual	Inlet	Outlet	Pump Vacuum In. Hg Gauge	Silica Gel Cond.	Stack	Filter Box	Imp Temp	XAD Cond	Probe	Filter Outlet

Train Leak Check:

Before Test: ______ CF in ____________ Seconds at ________ In. Hg
After Test: ______ CF in ____________ Seconds at ________ In. Hg

Comments:

Static Pressure

	Initial	Final	Port				
Pitot Tube Leak Check	○	○	Inches H_2O				
ORSAT Train Leak Check	○	○	Inches Hg				

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Project No.: ______ Date: ______ ______ Sheet ______ of ______
Client: ______ Run No.: ______ ______
Facility: ______ Sample Location: ______ ______
Source: ______ Operator: ______

Point	Clock Time		Dry Gas Meter, (ft^3)	Pitot In. H_2O ΔP	Orifice ΔH Inches H_2O		Dry Gas Temperature, °F		Pump Vacuum In. Hg Gauge	Silica Gel Cond.	Temperatures °F °C					
	24-hr	min			Desired	Actual	Inlet	Outlet			Stack	Filter Box	Imp Temp	XAD Cond	Probe	Filter Outlet

Meter Leak Check During Test: Meter Reading Comments:

Stop Start

______ CF in ______ Seconds at ______ In. Hg ______ ______
______ CF in ______ Seconds at ______ In. Hg ______ ______

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Project No.:	
Client:	
Facility:	
::	

Date:	
Run No.:	
Train Type:	
Sample ID:	
Recovery Person:	

FRONT HALF

Filter No.:			
Thimble No.:			

Comments:

XAD Trap No.:					Comments:
Final Wt. (g):					
Initial Wt. (g):					
Net Collected (g):					

IMPINGERS

Impinger No.:								
Reagent:								
Final Vol. (ml/g):								
Initial Vol. (ml/g):								
Net Collected (ml/g):								

Gel Impinger:				Comments:
Vol. (ml/g):				
Initial Vol. (ml/g):				
Net Collected (ml/g):				

Comments/Notes:

TOTAL MOISTURE (Impingers and Silica Gel) (g) =

ORSAT ANALYSIS

Project No.	______________________	**Date**	______________
Client	______________________	**Run**	______________
Facility	______________________	**Operator**	______________
Source	______________________	**Comments**	______________
Location	______________________		______________________

Orsat Leak Checked yes / no

Purge System with Sample Gas yes / no

Ambient Air Check CO_2 __________ O_2 __________.

Audit Gas Check (measured/actual): CO_2 ____/____ O_2 ____/____ CO ____/____

Expiration Date of Reagents ___/___/___

Sample Point	Time	CO_2 Reading 1	O_2 Reading 2		CO Reading 3		F_o
			Actual	Net	Actual	Net	

Net O_2 Reading = Reading 2 - Reading 1 (Actual)
Net CO Reading = Reading 3 - Reading 2 (Actual)

QC Validation

Calculate F_o

$$F_o = \frac{20.9 - \% O_2}{\% CO_2}$$

Fuel ______________________

Reported F_o ______________________

Expected F_o Ranges

Anthracite/Lignite	1.015 - 1.130
Bituminous	1.083 - 1.230
Distillate Oil	1.260 - 1.413
Residual Oil	1.210 - 1.370
Natural Gas	1.600 - 1.836
Wood Bark	1.000 - 1.120
Municipal Garbage	1.043 - 1.177
Other	__________

7

Client
Location
Tester
Date
Test Series

	O2		CO2		Nox		CO		SO_2		THC	
RANGE	25		20		200		100		50		100	
	Calibration Gases		Calibration Gases		Calibration Gases		Calibration Gases		Calibration Gases		Calibration Gases	
	Gas Conc.	Tank ID	Gas Conc.	Tank ID	Gas Conc.	Tank ID	Gas Conc.	Tank ID	Gas Conc.	Tank ID	Gas Conc.	Tank ID
GAS VALUES LOW	NA		NA		NA							
MID												
SPAN												
		Cal Error		Cal Error		Cal Error		Cal Error		Cal Error		Cal Error
ZERO	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
DIRECT RESPONSE LOW	NA		NA		NA		0	0.00%	0	0.00%	0	0.00%
MID	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
SPAN	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Direct Upscale Response	0		0		0		0		0		0	
Upscale Value												
Run #1		Bias		Bias		Bias		Bias		Bias		Bias
Initial Zero	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Initial upscale	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Start Time	00:00											
Stop Time	00:00											
Final Avg	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
		Drift		Drift		Drift		Drift		Drift		Drift
Final Zero	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Final Upscale	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Run #2		Bias		Bias		Bias		Bias		Bias		Bias
Initial Zero	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Initial upscale	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Start Time	00:00											
Stop Time	00:00											
Final Avg	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
		Drift		Drift		Drift		Drift		Drift		Drift
Final Zero	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Final Upscale	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Run #3		Bias		Bias		Bias		Bias		Bias		Bias
Initial Zero	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Initial upscale	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Start Time	00:00											
Stop Time	00:00											
Final Avg	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
		Drift		Drift		Drift		Drift		Drift		Drift
Final Zero	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Final Upscale	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Project No.:	Date:
Client:	Source:
ınt:	Analyst:

A. Filter Weights

Gross Weights

Run ______ Filter No. ______				Run ______ Filter No. ______				Run ______ Filter No. ______			
No.	RH/°F	Date/Time	Weight(g)	No.	RH/°F	Date/Time	Weight(g)	No.	RH/°F	Date/Time	Weight(g)
1	/	/		1	/	/		1	/	/	
2	/	/		2	/	/		2	/	/	

Final Gross Weight ______ g
Total Tare Weight ______ g
Residue Weight ______ g
Blank Weight ______ g
Net Weight ______ g

Final Gross Weight ______ g
Total Tare Weight ______ g
Residue Weight ______ g
Blank Weight ______ g
Net Weight ______ g

Final Gross Weight ______ g
Total Tare Weight ______ g
Residue Weight ______ g
Blank Weight ______ g
Net Weight ______ g

B. Beaker Weights

Rinse Volumes

Sample Volume ______ ml
ːh Volume ______ ml
ɹnk Correction
Sample: ____ ml × ____ g/mL = ____ g
Wash: ____ ml × ____ g/mL = ____ g

Sample Volume ______ ml
Wash Volume ______ ml
Blank Correction
Sample: ____ ml × ____ g/mL = ____ g
Wash: ____ ml × ____ g/mL = ____ g

Sample Volume ______ ml
Wash Volume ______ ml
Blank Correction
Sample: ____ ml × ____ g/mL = ____ g
Wash: ____ ml × ____ g/mL = ____ g

Gross Weights

Run ______ Beaker No. ______				Run ______ Beaker No. ______				Run ______ Beaker No. ______			
No.	RH/°F	Date/Time	Weight(g)	No.	RH/°F	Date/Time	Weight(g)	No.	RH/°F	Date/Time	Weight(g)
1	/	/		1	/	/		1	/	/	
2	/	/		2	/	/		2	/	/	

Final Gross Weight ______ g
Total Tare Weight ______ g
Residue Weight ______ g
Blank Weight ______ g
Net Weight ______ g

Final Gross Weight ______ g
Total Tare Weight ______ g
Residue Weight ______ g
Blank Weight ______ g
Net Weight ______ g

Final Gross Weight ______ g
Total Tare Weight ______ g
Residue Weight ______ g
Blank Weight ______ g
Net Weight ______ g

Total Net Weight (A+B) ______ g
Run _____Total Weight______ mg

Total Net Weight (A+B) ______ g
Run _____Total Weight______ mg

Total Net Weight (A+B) ______ g
Run _____Total Weight______ mg

Remarks:____

I. Calculations for Stack Volume and Isokinetic Ratio

Time =	T
Dry Gas Meter, ft^3 =	VM
Pitot ΔP, in. H_2O =	ΔP
Orifice ΔH, in. H_2O =	PM
Dry Gas Temp In, °F =	TMI
Dry Gas Temp Out, °F =	TMO
Stack Static Pressure, in. H_2O =	PST
Stack Temp, °F =	TS

1. DN = Nozzle Diameter, inches ______________ in.

2. PB = Barometric Pressure, inches Hg ______________ in.Hg

3. TT = Net Sampling Time, minutes ______________ min.

4. VM = VM final - VM initial = Sample Gas Volume, ft^3 ______________ ft^3

4A. VML = Use only if any final or intermediate leak check rate is over 0.02 cfm

LI = Leak rate after any given sampling period, cfm
TLI = Total time of sample period in which leak occurred, minutes
VML = VM - [(L1 - 0.02) TLI + (L2 - 0.02) TL2 + (L3 - 0.02) TL3 + (L4 - 0.02) TL4] = ______________ ft^3

5. Average Dry Gas Temperature at meter, °F

$$TM = \frac{\text{Average TMI} + \text{Average TMO}}{2}$$ ______________ °F

6. Average Orifice Pressure Drop, inches Hg

$$PM = \frac{\text{Average } \Delta H\text{, in. } H_2O}{13.6}$$ ______________ in. Hg

7. Volume of dry gas sampled at standard conditions, dscf [a]

$$VMSTD = \frac{528 \times (Y) \times (VM) \times (PB + PM)}{29.92 \times (TM + 460)}$$

Y = dry gas meter calibration factor

Y = ______________ ______________ ft^3

8 Total Water Collected

VW = gm H_2O silica gel + gm impinger H_2O ______________ gm

Note: If ml H_2O is measured - (ml × 0.9982 gm/ml = ____ gm)

9. Volume of water vapor at standard conditions, scf[b]

VW gas = 0.04715 × VW ______________ scf

10. Percent moisture in stack gas

$$\% M = \frac{100 \times VW\ gas}{VMSTD + VW\ gas}$$ ______________ %

10a. Percent moisture in stack gas - saturation (wet bulb/dry bulb method)

$$\% M = \frac{VP}{PS} \times 100$$ ______________ %

PS = Stack Pressure, absolute, inches Hg = PB ± Avg PST

PST = Stack static pressure

$$PST = \frac{PST\ in.\ H_2O}{13.6}$$ ______________ in. Hg

PS = PB ± Average PST ______________ in. Hg

TS_{dry} = Stack Temperature, dry

TS_{wet} = Stack Temperature, wet

Note: When TS_{dry} = TS_{wet}, the gas stream is saturated

SVP = water saturation vapor pressure at TS_{wet} ______________ in. Hg

$$VP = SVP - \left[0.00367 \times (PS) \times (TS_{dry} - TS_{wet}) \times \left(1 + \left(\frac{TS_{wet} - 32}{1571}\right)\right)\right]$$ ______________ in. Hg

11. Mole Fraction of dry gas (dimensionless)

100 - %M

MD = 100 ______________ %

Note: The proper %M must be used in this calculation. The % vapor moisture can never be greater than the saturation value at given stack temperature. If 10 is greater than 10a, this is an indication of water droplets in the gas stream.
If 10 < 10a - use 10 %M in calculation
If 10 > 10a - use 10a %M in calculation

12. Molecular weight of dry stack gas

$$MWD = (\%\,CO_2 \times 0.44) + (\%\,O_2 \times 0.32) + [(\%\,CO + \%\,N_2) \times 0.28]$$ ______________ mole dry

12a. % Excess Air

$$\%EA = \frac{[(\%\,O_2) - 0.5 \times (\%\,CO)] \times 100}{[(0.264) \times (\%\,N_2)] - (\%\,O_2) + 0.5 \times (\%\,CO)}$$ ______________ %

13. Molecular Weight of wet stack gas

$$MW = (MWD \times MD) + 18 \times (1 - MD)$$ ______________ lb/lb mole wet

14. AS = Stack Area, square inches

$$\text{Circular} = \left(\frac{\text{stack diameter}}{2}\right)^2 \pi$$ ______________ sq. in.

Rectangular = Length × Width ______________ sq. in.

15. PS = Stack Pressure, absolute, inches Hg = PB ± Avg PST
PST = Stack static pressure

$$PST = \frac{PST\ \text{in.}\ H_2O}{13.6}$$ ______________ in. Hg

PS = PB ± Average PST ______________ in. Hg

16. TS_{avg} = Average Stack Temperature ______________ °F

17. $$SDE_{avg} = \left(\sqrt{\Delta P}\right)_{avg} \times \sqrt{TS_{avg} + 460}$$ ______________

18. Stack gas velocity at stack conditions, afpm

$$VS = 5130^c \times Cp \times SDE_{avg} \times \left[\frac{1}{PS \times MW}\right]^{1/2}$$

Cp = pitot tube coefficient

Cp = ______________ ______________ afpm

1 Stack gas volumetric flow rate at stack conditions, acfm

$$Q_a = \frac{VS \times AS}{144}$$ ______________ acfm

20. Stack gas volumetric flow rate at standard conditions, dscfm[e]

$$Q_s = \frac{Q_a \times 528 \times MD \times PS}{(29.92) \times (TS_{avg} + 460)}$$ ______________ dscfm

21. Percent Isokinetics

$$\%ISO = \frac{1039^{f} \times (TS_{avg} + 460) \times VMSTD}{VS \times TT \times PS \times MD \times (DN)^2}$$ ______________ %

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[a] = Dry standard cubic feet at 68°F (528°R) and 29.92 in. Hg

[b] = Standard conditions at 68°F (528°R) and 29.92 in.Hg

[c] $$5130 = 85.5 \frac{ft}{sec}\left[\frac{(lb/lb\text{-}mole) \times (in.\ Hg)}{(°R) \times (in.\ H_2O)}\right] \times 60\ sec/min$$

[d] = Actual cubic feet per minute

[e] = Dry standard cubic feet per minute at 68°F (528°R) and 29.92 in.Hg

[f] = $$1039 = \frac{29.92\ in.\ Hg}{528°R} \times \frac{144\ in.^2}{ft^2} \times \frac{4}{\pi} \times 100$$

II. Calculations for Particulate Grain Loading and Emission Rates

1. Particulate, gr/dscf

$$gr/dscf = 0.0154 \times \left(\frac{mg}{VMSTD}\right)$$ ______________ gr/dscf

2. Particulate at stack conditions, gr/acf

$$gr/acf = \frac{528 \times gr/dscf \times PS \times MD}{29.92 \times (TS_{avg} + 460)}$$ ______________ gr/acf

3. Particulate, lbs/hr concentration method

$$lbs/hr = \frac{60\ min/hr \times gr/dscf \times Q_s}{7000\ gr/lb}$$ ______________ lbs/hr

4. Particulate, lbs/hr area method

$$lbs/hr = 0.132 \times \left[\frac{gms\ particulate \times AS}{\pi\left(\frac{DN}{2}\right)^2 \times TT}\right]$$ ______________ lbs/hr

5. $\frac{lbs/hr\ area \times 100}{Lbs/hr\ conc.}$ ______________ % I

6. Particulate, combustion lbs/MMBtu heat intput method

lbs/hr = average of area and concentration method ______________ lbs/hr

10^6Btu/hr = from fuel flow, steam generation or heat rate ______________ 10^6Btu/hr

$$lb/10^6Btu/hr = \frac{lbs/hr}{10^6Btu/hr}$$ ______________ lb/10^6Btu

7. Lbs/10^6Btu F-Factor Method

$$lbs/10^6Btu = \frac{gr/dscf}{7000} \times F\text{-factor} \times \frac{20.9}{(20.9 - \%\ O_2)}$$ ______________ lbs/10^6Btu

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